

OFFICIAL PUBLICATIONS OF CORNELL UNIVERSITY

VOLUME II

NUMBER 6

ANNOUNCEMENT OF THE GRADUATE SCHOOL 1911-12

MARCH 15, 1911
PUBLISHED BY CORNELL UNIVERSITY
ITHACA, NEW YORK

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CALENDAR, 1911-12

First term.	Sept. 28, 1911.	Instruction begins.
	Sept. 30, 1911.	Registration of graduate students.
Second term.	Feb. 12, 1912.	Registration of graduate students.
	June 20, 1912.	Commencement.

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The abbreviations in parentheses indicate the Colleges to whose special announcements prospective graduate students are referred for more detailed information concerning advanced work in the various subjects. See page 12. A & S. = College of Arts and Sciences; Agr. = College of Agriculture; Arch. = College of Architecture; C. E. = College of Civil Engineering; M. E. = Sibley College of Mechanical Engineering; Med. = Medical College; Vet. = Veterinary College; Chem. = Announcement of the Department of Chemistry.

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THE GRADUATE SCHOOL

ADMISSION

The Graduate School has exclusive control of all graduate work done in the University. Graduates of the following colleges of this University, namely, the College of Arts and Sciences, the Medical College, the College of Architecture, the College of Civil Engineering, the Sibley College of Mechanical Engineering, and the New York State College of Agriculture,—or of other institutions in which the requirements for the first degree are substantially equivalent,—are eligible for admission to the Graduate School. In other cases, studies pursued after graduation and experience gained by professional work or otherwise are taken into consideration in deciding whether the candidate's preparation as a whole is such as to justify his admission to the Graduate School.

Seniors in the colleges of Cornell University who have completed the work required for the bachelor's degree may, under certain conditions to be ascertained from the deans of their respective colleges, be admitted to the Graduate School.

In order to avoid delays at the beginning of the academic year, those who desire to enter the Graduate School are advised to make application for admission, either in person or by letter, in the preceding spring or summer. Correspondence should be addressed to the Dean of the Graduate School, Cornell University, Ithaca, N. Y.

Before admission it will be necessary to present evidence of the degree already received, i.e., either the diploma or a statement from some official source. The simplest procedure will ordinarily be to submit an official statement from the Registrar or Dean that the degree has been conferred. In the case of graduates of Cornell University this is not necessary, since the records are conveniently accessible.

REGISTRATION

Students who have been admitted to the Graduate School are required to register at the office of the Registrar of the University at the beginning of each term, unless special permission for later registration has been granted by the Dean.

STUDIES

All advanced courses of study offered in the University, and all the facilities for study and investigation afforded by its libraries and laboratories, are open to students in the Graduate School, subject only to the condition of their being qualified by previous study or experience to undertake the particular work desired.

The purpose of the Graduate School is to provide the student with the method and discipline of original research, to the ultimate end that he may contribute to the advancement of knowledge. In furnishing this oppor-

tunity for independent study and investigation, the Graduate School seeks to make the conditions such as will enable the student to devote himself wholly to his chosen field. Unhampered by the restrictions that necessarily obtain in undergraduate work, he will come into freedom of association with older scholars, who will seek to make his work profitable to him by giving such aid and direction as he may need. Inasmuch as subjects differ greatly, the requirements for all subjects cannot be stated in terms at once specific and uniform. In some departments of knowledge, original research may begin with the student's entrance into the School, while in other subjects much preliminary work is necessary to fit the student for profitable research.

The branch of knowledge to which the student intends to devote the larger part of his time is termed his major subject. The other fields of study selected, which will be necessarily more restricted in their scope and which should in general be selected with reference to their direct bearing upon the major subject, are termed the minor subjects. A statement of the major and minor subjects, approved by the professors with whom the work is taken, must be presented to the Dean not later than two weeks after admission to the Graduate School. Candidates for the doctor's degree are required to select a major subject and two minor subjects; for the master's degree, a major subject and one minor subject are required.

SPECIAL COMMITTEES

The work of each graduate student is in charge of a committee consisting of two or more professors under whom his major and minor subjects are pursued, the professor of his major subject being chairman. The student is expected to confer freely with the members of his special committee, not only in connection with individual courses of study but also in regard to the general plan of his work.

THE DEGREE OF DOCTOR OF PHILOSOPHY

The degree of Doctor of Philosophy is granted to a student who, after completing not less than three years of resident graduate work, presents a satisfactory thesis and passes an examination.

Examinations for the doctor's degree will occur during the second week before Commencement, unless another date is set by the Dean. These examinations, which may be either oral or written, or both, at the option of the examining committee, are open to all members of the faculty. Candidates who will have completed the other requirements for the degree in June must apply to the Dean, not later than April 15th, for examination. A list giving the dates of the examinations and the members of the examining committees will be issued early in May.

The thesis for the doctor's degree must be of such character as shall demonstrate the candidate's ability to do original work, and must be satisfactory in style and composition. A statement of the general subject of the thesis, with the written approval of the chairman of the special committee in charge of the candidate's work, must be furnished the Dean not later than

December 1st of the academic year in which the degree is to be taken. The completed thesis, approved by the chairman of the special committee, must be presented to the Dean at least five days before the examination for the degree. This copy may be returned for use at the examination, or for binding.

Each candidate for the doctor's degree must deposit fifty printed copies of his thesis with the Librarian of the University. If the printing of the thesis is deferred until after Commencement the candidate must deposit a bound typewritten copy with the Dean not later than the Friday preceding Commencement. The size of the page in case of typewritten theses should be $8 \times 10 \frac{1}{2}$ inches. This copy of the thesis becomes the permanent property of the Library. The diploma for the degree will be withheld until the required number of printed copies has been deposited.

The candidate should consult with the Dean regarding the form of publication of the thesis. The title page must include the statement that the thesis is presented to the Faculty of the Graduate School of Cornell University for the degree of Doctor of Philosophy. The author's name must be given in full, and, if the thesis is a reprint, the place and date of the original publication must be given.

Candidates for the doctor's degree will ordinarily be expected to have a working knowledge of French and German before beginning graduate work; and in all cases they must, before beginning their second year of residence, show to the satisfaction of their special committees that they possess a reading knowledge of those languages. If the subjects chosen by the candidate are of such character as to make it desirable that he should be familiar with some foreign language other than French or German, the special committee may, with the consent of the Dean, permit the substitution of that language for one of the two required.

Not all students admitted to the Graduate School may expect to obtain the doctor's degree at the end of the minimum period of three years. Those whose undergraduate work has been insufficient in amount or too narrowly specialized, as well as those whose preparation in their special field is inadequate, must count upon spending some time—determinable by their proficiency—in work of a character not so advanced as that implied in the minimum residence requirement. The minimum residence requirement of three years applies only to graduates of a four years' course in some college of this University, and to graduates of other institutions who have pursued a course of study substantially equivalent to that required for the first degree in one of the colleges of this University.

Resident graduate study elsewhere may, by permission of the Faculty, be accepted as the equivalent of residence at this University. No general statement can be made regarding the conditions under which this permission will be granted; each case will be decided on its merits. A request for credit for resident work elsewhere must be approved by the student's special committee. At least one year's residence in this University is required in all cases.

Residence for the master's degree may be credited toward the residence required for the degree of Doctor of Philosophy provided the special com-

mittee in charge of the work approve, certifying the work done as suitable for the doctor's degree.

Graduate work carried on by a candidate who is at the same time an instructor or an assistant is estimated on the basis of a four years' minimum residence requirement for the doctor's degree.

THE MASTER'S DEGREE

Cornell University confers the degrees of Master of Arts, Master of Civil Engineering, Master of Mechanical Engineering, Master of Science in Agriculture, and Master of Architecture.

A candidate for the master's degree must spend at least one year in residence at this University and pursue, under the direction of his special committee, a course of advanced study including one major and one minor subject. He must then present a satisfactory thesis and pass an examination.

Examinations for the master's degree will occur during the second week before Commencement, unless another date is set by the Dean. These examinations, which may be written, or oral, or both, at the option of the examining committee, are open to all members of the faculty. Candidates who will have completed the other requirements for the degree in June must apply to the Dean, not later than April 15th, for examination. A list giving the dates of the examinations and names of the examining committees will be issued early in May.

The thesis for the master's degree must be of such character as to demonstrate the student's ability to do original work and must be satisfactory in style and composition. A statement of the general subject of the thesis, with the written approval of the chairman of the special committee in charge of the candidate's work, must be furnished the Dean not later than December 1st of the academic year in which the degree is to be taken. The completed thesis, approved by the chairman of the special committee, must be presented to the Dean at least five days before the examination for the degree. This copy may be returned for use at the examination or for binding.

Each candidate for the master's degree is required to furnish a bound typewritten copy of his thesis for the use of the University Library, and this copy is to be delivered to the Dean on or before the Friday preceding Commencement. The size of the page in the case of typewritten theses should be $8 \times 10\frac{1}{2}$ inches. This copy of the thesis becomes the permanent property of the Library.

Not all students admitted to the Graduate School may expect to receive the master's degree in the minimum time of one year. Those whose undergraduate work has been insufficient in amount, as well as those whose preparation in their special field is inadequate, must expect to spend some time in preparatory work. The minimum requirement of one year applies only to students whose preparation at the time of entering the Graduate School is in all respects equivalent to that implied by the corresponding first degree from this University.

FELLOWSHIPS AND GRADUATE SCHOLARSHIPS

All applications for fellowships and graduate scholarships must be made on official forms to be obtained from the Dean of the Graduate School, and must be submitted to him on or before April 15th of the academic year preceding the one for which application is made. The formal application should be accompanied by a copy of any literary or scientific work already published by the candidate, and by a detailed description of any similar work as yet unpublished. Applicants personally unknown to the appointing body are urged to give the most full and exact information concerning themselves and their academic experience.

The following twenty-three fellowships are annually offered in the Graduate School.

1. The Cornell Fellowship in English.
2. The McGraw Fellowship in Civil Engineering.
3. The Sage Fellowship in Chemistry.
4. The Schuyler Fellowship in Physiology; Vertebrate Zoology, including Anatomy and Histology and Embryology; or Invertebrate Zoology and Entomology.
5. The Sibley Fellowship in Mechanical and Electrical Engineering.
6. The Goldwin Smith Fellowship in Botany; Geology; or Physical Geography.
7. The President White Fellowship in Physics.
8. The Erastus Brooks Fellowship in Mathematics.
9. The University Fellowship in Architecture.
10. The University Fellowship in Romance Languages.
11. The University Fellowship in German.
12. The University Fellowship in Agriculture or Veterinary Science.
13. The University Fellowship in Mechanical and Electrical Engineering.
14. The President White Fellowship in Modern History.
15. The President White Fellowship in Political and Social Science.
- 16-17. The Susan Linn Sage Fellowships in Philosophy.
18. The Susan Linn Sage Fellowship in Psychology.
- 19-20. The Fellowships in Political Economy.
- 21-22. The Fellowships in Greek and Latin.
23. The Fellowship in American History.

The President White Fellowships in Modern History and in Political and Social Science have an annual value of \$600 each; the others have an annual value of \$500 each.

The following sixteen graduate scholarships are annually offered in the Graduate School.

- 1-5. The Susan Linn Sage Graduate Scholarships in Philosophy.
6. The Susan Linn Sage Graduate Scholarship in Psychology.
7. The Graduate Scholarship in Mathematics.
8. The Graduate Scholarship in Chemistry.
9. The Graduate Scholarship in Physics.
10. The Graduate Scholarship in Civil Engineering.
11. The Graduate Scholarship in Latin and Greek.
12. The Graduate Scholarship in Archaeology and Comparative Philology.

13. The Graduate Scholarship in Physiology; Vertebrate Zoology, including Anatomy and Histology and Embryology; or Invertebrate Zoology and Entomology.

14. The Graduate Scholarship in Botany; Geology; or Physical Geography.

15. The Graduate Scholarship in English.

16. The Graduate Scholarship in History.

The graduate scholarships have an annual value of \$300 each.

The term of each fellowship and graduate scholarship is one year; but the term may under exceptional circumstances be extended to two years.

The moneys due on fellowships and graduate scholarships are paid at the office of the Treasurer of the University in six equal payments, on October 15, December 1, January 15, February 15, April 1, and May 15.

In view of the fact that practical University instruction will be of use in training fellows and scholars for future usefulness, each holder of a fellowship or graduate scholarship shall be liable to render service to the University in the work of instruction or examination to the extent of four hours a week through the academic year.

All persons elected to fellowships and graduate scholarships are required, upon accepting their appointments, to file a bond that, in case of their resignation before the expiration of the time for which they were appointed, they will repay to the University any sums that they may have received. The bond must be for the value of the fellowship or the scholarship and must have two sureties approved by the Treasurer of the University.

The President White Fellowships in History and Political Science may, in the discretion of the Faculty of the Graduate School, be made traveling fellowships. In the case of a student of very exceptional ability and promise in the fields of either of these fellowships, the two fellowships may, in the discretion of the Faculty, be combined for a single year into one.

Honorary Fellowships

Persons upon whom the doctor's degree has already been conferred may, in the discretion of the Faculty of the Graduate School, be appointed to honorary fellowships. These fellowships cover tuition fees only. Actual residence at the University and regular registration in the Graduate School are required of appointees.

GRADUATE WORK IN THE SUMMER

Members of the University Faculty who may desire to offer summer work for graduate students have been authorized by the Faculty of the Graduate School to do so; and students taking such summer work, may, at the discretion of their special committee, be relieved from residence during an equal part of the University year. This statement refers not only to work done during the summer session, but to graduate work done at any time during the summer. No graduate student may, however, receive credit for more than two terms' residence during any twelve consecutive months; and work

done during the summer must be done under the personal direction of the member of the committee having charge of the work.

Work done in the summer session of this University, under direction of a member of the Faculty of the Graduate School, may be counted for residence toward the master's degree under the following conditions: one term's residence to be satisfied by three summer sessions, and two terms' residence by five summer sessions.

It should be noted that in many subjects no graduate work is offered in the summer session. A statement of the graduate work offered will be found in the Announcement of the Summer Session, which will be sent on application to the Registrar.

FEES

A matriculation fee of \$5 is charged all students on entering the University.

Every student (except those registered in the Medical College in New York City) is charged an Infirmary fee of \$2.00 a term, payable at the beginning of each term. In return for the Infirmary fee, any sick student is on his physician's certificate admitted to the Infirmary, or in the case of those contagious diseases which under present rules cannot be there cared for, to the Ithaca City Hospital, if receivable under its rules, and is given without further charge a bed in a ward, board, and ordinary nursing, for a period not exceeding two weeks in any one academic year.

Extra charges are made for private rooms, special foods, and special nurses. If a sick student who has not received two weeks' service in the year is refused admittance to either the Infirmary or the City Hospital, by reason of lack of accommodation, he is entitled to a refund of the fee for both terms.

Students taking work in Sibley College are charged \$10 a term for material used in Sibley College shops and laboratories.

A graduation fee of \$20 is required of each person about to take an advanced degree. This fee must be paid at least ten days before Commencement. The amount will be refunded should the degree not be conferred.

Every person taking laboratory work or laboratory courses must pay to the Treasurer the fee or the deposit for the materials to be used in the work.

The annual fees for tuition for students registered in the Graduate School, including Fellows and Scholars, whether candidates for a degree or not, are as follows: for students whose major subject is in the College of Arts and Sciences, \$100.00; for students whose major subject is in Sibley College, the College of Civil Engineering, the College of Architecture, or the Medical College, \$150.00; for students who are not residents of the State of New York and whose major subject is in the New York State College of Agriculture or the New York State Veterinary College, \$100.

In case no major subject is taken, the tuition is the same as the regular tuition of the College in which two-thirds of the work of the graduate student is done.

For students who for a year or more preceding admission have been residents of the State of New York, and whose major work is in the New York State College of Agriculture or the New York State Veterinary College, tuition is free.

UNIVERSITY LIBRARIES

G. W. Harris, Librarian; A. C. White, Assistant Librarian, in charge of Classification; W. H. Austen, Assistant Librarian, in charge of the Reference Library; G. L. Burr, Librarian of the President White Library; A. H. R. Fraser, Librarian of the Law Library; A. J. Lamoureux, Librarian of the Agricultural Library; H. Hermannsson, in charge of the Icelandic Collection; Miss M. Fowler, in charge of the Petrarch and Dante Collections.

The University Libraries comprise the General Library of the University, the eight Seminary Libraries, the Law Library, the Flower Veterinary Library, the Barnes Reference Library, the Library of the State College of Forestry, the Goldwin Smith Hall Library, the Stimson Hall Medical Library, and the Library of the New York State College of Agriculture. The total number of bound volumes in them is now over three hundred and ninety thousand and is increasing at the rate of about twelve thousand volumes a year. The number of periodicals, transactions, and other serials, currently received, is over two thousand, and of most of these complete sets are on the shelves. The General Library of the University, seven Seminary Libraries, and the Forestry Libraries are all grouped under one roof in the Library Building, while the remaining collections are to be found in the buildings devoted to their respective subjects.

Among the more important special collections in the General Library, may be mentioned: THE ANTHON LIBRARY, of nearly seven thousand volumes, the collection made by the late Professor Charles Anthon, of Columbia College, in the ancient classical languages and literatures, besides works in history and general literature; THE BOPP LIBRARY, of about twenty-five hundred volumes, relating to the oriental languages and literatures, and comparative philology, being the collection of the late Professor Franz Bopp of the University of Berlin; THE GOLDWIN SMITH LIBRARY, of thirty-five hundred volumes, comprising chiefly historical works and editions of the English and ancient classics, presented to the University in 1869 by Professor Goldwin Smith, and increased during later years by the continued liberality of the donor; THE PUBLICATIONS of the Patent Office of Great Britain, about three thousand volumes; THE WHITE ARCHITECTURAL LIBRARY, a collection of over twelve hundred volumes relating to architecture and kindred branches of science, given by ex-President White; THE KELLY MATHEMATICAL LIBRARY, comprising eighteen hundred volumes and seven hundred tracts, presented by the late Hon. William Kelly, of Rhinebeck; THE SPARKS LIBRARY, being the library of Jared Sparks, sometime President of Harvard University, consisting of upward of five thousand volumes and four thousand pamphlets, relating chiefly to the history of America; THE MAY COLLECTION, relating to the history of slavery and anti-slavery, the nucleus of which was formed by the gift of the library of the late Rev. Samuel J. May, of Syracuse; THE SCHUYLER COLLECTION of folk-lore, Russian history and literature, presented by the late Hon. Eugene Schuyler in 1884; THE PRESIDENT WHITE HISTORICAL LIBRARY, of about twenty thousand volumes (including bound

collections of pamphlets) and some three thousand unbound pamphlets, the gift of ex-President White, received in 1891, especially rich in the primary sources of history, and containing notable collections on the period of the Reformation, on the English and French Revolutions, on the American Civil War, and on the history of superstition; **THE SPINOZA COLLECTION**, numbering four hundred and fifty volumes, presented in 1894, by ex-President White; the four remarkably rich collections given by the late Willard Fiske, comprising the **DANTE COLLECTION**, containing at present seven thousand volumes, the **PETRARCH COLLECTION**, containing about three thousand five hundred volumes, the **RHAETO-ROMANIC COLLECTION**, containing about thirteen hundred volumes, and the **ICELANDIC COLLECTION**, containing about nine thousand volumes; **THE ZARNCKE LIBRARY**, containing about thirteen thousand volumes and pamphlets, especially rich in Germanic philology and literature, purchased and presented in 1893 by William H. Sage; **THE HERBERT H. SMITH COLLECTION** of books relating to South America, purchased in 1896; a valuable collection of books on French and Italian society in the 16th and 17th centuries, presented by Professor T. F. Crane in 1896; **THE FLOWER VETERINARY LIBRARY**, the gift of ex-Governor Flower to Cornell University, for the use of the State Veterinary College, in 1897; **THE EISENLOHR LIBRARY**, containing about one thousand volumes on Egyptology and Assyriology purchased and presented in 1902 by A. Abraham; **BAYARD TAYLOR'S** Correspondence and journals and his collection of Goethe literature, presented to the Library in 1905 by Mrs. Marie Taylor.

THE LAW LIBRARY contains an unusually complete collection of American, English, and Colonial reports, with complement of text-books and statutes, and complete sets of all the leading law periodicals in English.

These collections and others such as these, making possible an exhaustive study of certain fields, are of the greatest service in training in research. A similar purpose is served by the seminary rooms of the University Library. Thus, for the study of English, of the classical languages, of the Germanic and Romance languages, of Philosophy, of Politics and Economics, of American and of European History, there have been provided in the Library Building seven of these research rooms, each equipped with a carefully chosen body of reference books, to which advanced students in these fields have access. In connection with the scientific and technical laboratories similar collections have been formed, well supplied with reference books, standard works and sets of periodicals, conveniently arranged for study and research.

Cards of admission to the shelves in the stack-rooms and to the White Historical Library will be issued by the librarian to graduate students for the purpose of consultation and research. While the library is primarily a reference library, the privilege of taking books for home use is granted to all students that comply with the Library regulations.

FURTHER FACILITIES FOR GRADUATE STUDY AND COURSES OF INSTRUCTION

The courses outlined in the following pages are grouped primarily on the basis of subject-matter. Under each subject there is given, in a separate paragraph, a list of courses which are too elementary in character to be likely to interest graduate students of that subject. There then follows a list of all those courses which, whether open or not open to undergraduates, are deemed likely to be of profit to graduate students.

More detailed information concerning any one of these various courses (time and place of meeting, and, in the case of a few courses given in alternate years, whether or not offered in 1911-12, etc.) will be found in the separate announcement of the College in which the particular course is given. These special announcements of the various Colleges are ready for distribution not later than May 15, and any one of them may be obtained gratis and post-free on application to the Dean of the Graduate School.⁵

SEMITIC LANGUAGES AND LITERATURES

PROFESSOR: NATHANIEL SCHMIDT.

Special facilities for advanced work in this subject are: 1. a collection of several hundred squeezes of inscriptions found in Syria and Arabia Petraea, chiefly in Arabic, Hebrew, Syriac, Assyrian, Nabataean, and Greek; squeezes of Old Egyptian, Coptic, and Hittite inscriptions; 2. a collection of several thousand photographs taken in Syria and Arabia Petraea, and slides taken from these photographs; 3. reproductions of inscriptions and objects of art in the Museum of Casts; 4. a valuable collection of Arabic, Hebrew, Samaritan, Ethiopic, and Coptic manuscripts secured in Syria; 5. the Eisenlohr library, especially rich in Egyptology; 6. the Fiske collection of Arabic books.

To the candidate for an advanced degree, opportunities are offered of studying every Semitic language and dialect, and also Shumerian, Old Egyptian, and Coptic. The student may, if he so chooses, specialize in Semitic literature, or in Oriental history.

Advanced Hebrew.
Neo-Hebraic.
Ethiopic.
Assyrian.

Shumerian.

Aramaic (Mandaic, Babylonian Talmudic, Syriac, Nabataean, Palmyrene, Galilaean, Samaritan, and Judaeae).

Arabic (Sabaean and Minaean, Classical, Modern).

Advanced Arabic.

Egyptian.

Coptic.

Comparative Semitic Philology.

Semitic Epigraphy (in Semitic Seminary).

Hebrew Literature (in Semitic Seminary).

The History of Asia.

The History of Africa.

The Sources of Oriental History (in Historical Seminary).

GREEK

Professors: J. R. S. STERRETT; G. P. BRISTOL; H. L. JONES.

Instructor: E. P. ANDREWS. Reader: A. C. WHITE.

The general library and the special library of over two thousand volumes in the seminary rooms afford ample facilities for graduate work. The special library is rich in complete sets of philological and archaeological periodicals in various languages, and contains all the standard works that form the laboratory apparatus of the graduate student. Other books will be transferred from the general library to the seminary rooms as they are needed.

In general, the student who wishes to do graduate work in Greek should have pursued classical studies (Greek, Latin, and kindred topics) systematically to the end of his senior year in college. The ability to read German is necessary, and the ability to read French is greatly to be desired.

Elementary Greek; Xenophon's *Hellenica*, Homer's *Odyssey*; Lysias; Herodotus; Greek Composition; Euripides, the *Iphigeneia in Tauris* and the *Medea*; Sophocles, the *Oedipus Tyrannus* and the *Antigone*; the *Iliad*; Plato, *Republic*, or Demosthenes, *On the Crown*.

Theocritus, Bion, Moschus, and Herondas. Professor STERRETT.

Aristophanes, *Birds* and *Clouds*. Professor STERRETT.

New Testament. Dr. WHITE.

Greek Life. Professor STERRETT.

Myths of the Epic Cycle. Professor STERRETT.

Advanced Greek Composition. Assistant Professor JONES.

History of Greek Poetical Literature. Professor STERRETT.

History of Greek Prose Literature. Professor STERRETT.

Pausanias. Mr. ANDREWS.

Modern Greek. Mr. ANDREWS.

Rapid Reading of the Tragedies of Euripides. Professor STERRETT.

The Critical Study of the *Agamemnon* of Aeschylus. Professor STERRETT.

Pindar. Professor STERRETT.

The Dialect of Homer. Professor STERRETT.
 Greek Epigraphy. Mr. ANDREWS.
 Greek Seminary. Professor STERRETT.
 General and Comparative Philology. Professor BRISTOL.

LATIN

Professors: C. E. BENNETT; H. C. ELMER; C. L. DURHAM.

Graduate students in Latin have the use of the Latin Seminary, consisting of two rooms in the Library building. The Seminary contains several thousand volumes of texts and other works of reference, including complete sets of all the journals of classical philology. Two Greek and Latin fellowships and one scholarship are annually awarded.

Livy, Cicero, Horace; Sight Translation; Virgil's Aeneid, Books I-VI; Latin Conversation and Oral Composition; Terence, Horace, Tacitus; Sight Translation for Sophomores; Catullus, Virgil, Ovid, Martial; Cicero's Letters, Cicero de Oratore, Book I; Cicero's De Officiis, Cicero's Second Philippic; Plautus, Lucretius, Lectures on the History of Roman Literature; Suetonius, Pliny, Tacitus; Intermediate Course in Latin Writing; Teachers' Training Course; Roman Private and Political Antiquities; Cicero in Verrem; Virgil, Aeneid VII-XII.

Latin Seminary. Professor BENNETT.
 History, Aim, and Scope of Latin Studies. Professor BENNETT.
 Historical Latin Syntax. Professor BENNETT.
 Historical Grammar of the Latin Language. Professor BENNETT.
 Latin Writing, Advanced Course. Professor ELMER.
 History and Development of Roman Epic Poetry. Professor ELMER.
 Vulgar Latin. Professor DURHAM.
 Ennius, Fragments of the Annales. Professor DURHAM.
 Latin Epigraphy. Professor DURHAM.
 Carmina Latina Epigraphica. Professor DURHAM.

GERMAN

Professors: A. B. FAUST; P. R. POPE; H. C. DAVIDSEN; E. J. FLUEGGE;
 A. W. BOESCHE.
 Instructors: A. L. ANDREWS; W. D. ZINNECKER.

In the advanced courses in this subject, the work is two-fold, literary and philological. The history of German literature from the earliest period to the present day is given in outline lecture courses with collateral reading. Special topics are selected for more minute study, such as the epic and lyrical poetry of the Middle High German period, the literature of the Reformation, the Classical period, the Romantic School, the modern drama. The courses offered in philology include the study of Gothic, Old and Middle High German, and Old Norse. They afford also an introduction to the science of language and the principles of phonetics.

The seminaries in German literature and philology aim to impart the principles and methods of rigid investigation. A teachers' course deals with class-room methods and theories of instruction in the modern languages.

The work in this subject is greatly assisted by exceptional library facilities. The nucleus was formed by the acquisition of the Zarncke library, one of the largest collections of rare books for the study of German literature and philology ever brought to America. With constant enlargements the library has become one of the most serviceable in the country. The University Library also contains the Willard Fiske collection of books on Icelandic literature, one of the most complete in existence. The German seminary room in the University Library contains books for ready reference, including philological journals and reviews.

The Deutscher Verein, an organization connected with the department, has gained strength and importance in fostering interest in German studies at Cornell University. Its purpose is both educational and social. At its bi-weekly meetings, literary and musical programs are rendered, sometimes formal, at other times informal, the use of the German language is encouraged, and opportunity is afforded for a closer acquaintance between faculty and students.

Candidates for advanced degrees in German are expected to have an adequate knowledge of French and Latin.

Elementary German; Second German Course; Elementary German Composition and Conversation; Advanced German Composition and Conversation; Intermediate German Course; Reading Course; Rapid Reading Course.

Schiller's Life and Early Dramas. Assistant Professor FLUEGEL.

Schiller's Wallenstein. Assistant Professor FLUEGEL.

Goethe. Professor FAUST.

Goethe's Faust. Professor FAUST.

History of German Literature. Professor FAUST.

The German Drama of the Nineteenth Century. Assistant Professor DAVIDSEN.

The Literature of the Reformation. Assistant Professor DAVIDSEN.

Lessing. Assistant Professor DAVIDSEN.

The Romantic Movement in Germany. Assistant Professor BOESCHE.

Bismarck, the Man and his Time. Assistant Professor BOESCHE.

Friedrich Hebbel. Assistant Professor DAVIDSEN.

Henrik Ibsen. Assistant Professor DAVIDSEN.

Richard Wagner, His Life and Works. Assistant Professor POPE.

German Lyrics and Ballads. Assistant Professor POPE.

Sturm und Drang. Assistant Professor BOESCHE.

Models of German Style. Assistant Professor DAVIDSEN.

German Folklore. Assistant Professor FLUEGEL.

Lectures in German on Germany and German Institutions. Assistant Professor DAVIDSEN.

Lectures in German on German Art. Assistant Professor DAVIDSEN.

The History of the German Element in the United States. Professor FAUST.

Scientific German. Assistant Professor FLUEGEL.

Elementary Phonetics and its Application to the Study of Modern Languages. Assistant Professor DAVIDSEN.

Principles of Word-Formation. Assistant Professor DAVIDSEN.

Topics in Historical German Syntax. Assistant Professor BOESCHE.

Elementary Middle High German. Assistant Professor POPE.

Modern Scandinavian. Dr. ANDREWS.

Teachers' Course. Professor FAUST.

Advanced Middle High German. Assistant Professor POPE.

Gothic. Assistant Professor BOESCHE.

Old High German. Assistant Professor POPE.

Old Icelandic. Dr. ANDREWS.

History of Modern High German. Dr. ANDREWS.

German Seminary. Professor FAUST.

Philological Seminary. Assistant Professors POPE and BOESCHE.

Introduction to the Study of Language. Professor BRISTOL.

ROMANCE LANGUAGES AND LITERATURES

Professors: W. W. COMFORT; E. W. OLMSTED; O. G. GUERLAC; A. LIVINGSTON; A. GORDON.

Instructors: J. F. MASON; L. PUMPELLY.

The collection of French books in the University Library is very large, and offers excellent facilities for advanced work. The Spanish library, though in large measure recently acquired, is quite representative. Objects of special pride are the unrivalled Dante and Petrarch collections, the gift of the late Willard Fiske, who likewise presented to the University a unique collection of Rhaeto-Romance works. Smaller collections of Portuguese and Provençal books are also to be found in the University Library. The seminary library contains several thousand volumes including a complete set of bound periodicals. A University fellowship (of the value of \$500) in Romance languages is annually awarded.

The courses of study in this subject are divided into three categories: those intended primarily for undergraduates, those intended alike for undergraduates and graduates, and those intended primarily for graduates. All candidates for advanced degrees in this subject must possess a thorough reading knowledge of Latin, French, and German.

Candidates for the degree of Master of Arts whose major subject is in Romance languages are expected to present for the approval of the chairman of their special committee, within two weeks after registration day, an outline of the work planned for the year. The thesis must, before May 1, be submitted for the criticism of the chairman of the candidate's special committee. The course in French philology is required of graduate students in their first year of study.

Candidates for the degree of Doctor of Philosophy are expected to follow advanced courses given in the branch in which their major subject lies, and

to take up such work as will give a comprehensive view of the branches in which their minor subjects lie. It is intended that the last year of preparation for this degree shall be spent chiefly upon the thesis. Further information regarding details may be obtained from the professors in the subject.

NOTE.—No distinction will be made between language and literature in the counting of major and minor. Thus, French language and literature subjects counts as only one subject.

First Year French; Second Year French; Third Year French; Elementary French Conversation and Composition; First Year Italian; First Year Spanish.

History of French Literature. Professor COMFORT and Assistant Professor GUERLAC.

French Literature of the Seventeenth Century. Professor COMFORT.

French Literature of the Eighteenth Century. Professor OLMSTED.

French Literature of the Nineteenth Century. Mr. MASON.

French Dramatic Literature. Professor OLMSTED.

The French Philosophers, Moralists, and Historians. Assistant Professor GUERLAC.

History of French Literary Criticism. Assistant Professor GUERLAC.

Advanced French Conversation and Composition. Assistant Professor GUERLAC.

French Lyric Poetry. Professor OLMSTED.

French Phonetics. Mr. MASON.

French Literature of the Sixteenth Century. Assistant Professor GORDON.

French Philology. The first term's work is devoted to a study of Vulgar

Latin. Professor DURHAM and Assistant Professor GORDON.

Medieval French Literature. Professor COMFORT.

Teachers' Course. Conducted by the Staff of the Department.

Old French Texts. Professor COMFORT.

Second Year Italian. Assistant Professor LIVINGSTON.

Petrarch and Modern Poetry. Assistant Professor LIVINGSTON.

Boccaccio and Modern Prose. Assistant Professor LIVINGSTON.

Dante and the Middle Age. Assistant Professor LIVINGSTON.

Old Italian. Assistant Professor LIVINGSTON.

Second Year Spanish. Assistant Professor GORDON.

Spanish Classical Literature. Professor OLMSTED.

Old Spanish. Professor OLMSTED.

Spanish Seminary. Professor OLMSTED.

Portuguese Grammar and Reading. Professor OLMSTED.

Old Provençal. Assistant Professor LIVINGSTON.

ENGLISH

Professors: M. W. SAMPSON; W. STRUNK, JR.; F. C. PRESCOTT; C. S. NORTHUP; LANE COOPER; J. Q. ADAMS, JR.

Instructors: B. S. MONROE; E. G. COX; E. J. BAILEY; R. R. KIRK; F. M. SMITH; F. A. PEEK; L. N. BROUGHTON; D. W. PRALL.

Among the books available to the student are complete sets of the publications of the Early English Text, Chaucer, Scottish Text, Percy, English Dialect, Shakespeare, New Shakspeare, Spenser, Philological, Malone, and other societies; of the various Bullen and Grosart reprints; and of all the important periodicals dealing with the English language and literature. Most of the foreign dissertations on English subjects, standard and other editions of individual authors, English and American, and several special collections, are also in the library, which is exceptionally good in the field of Old English, and in the Elizabethan and Victorian periods. The department has a seminary room in the library building. A fellowship and a scholarship are annually awarded.

Candidates for an advanced degree may take their major subject in literature or in language. In general, thirty-six hours (i. e., three full years) of college English are required before a student may enter upon candidacy for an advanced degree. Work in philosophy, history, and advanced languages, ancient and modern, may be counted against shortage in undergraduate English, two hours in these subjects standing for an hour in English. All candidates must complete a satisfactory amount of work in Old English; must have a general knowledge of English literature and English history; and must accomplish satisfactory work in research. Candidates for the master's degree must have sufficient knowledge of French or German to make use of scholarly works in one of those languages, and candidates for the doctor's degree must have a similar knowledge of both French and German, and a knowledge of Latin.

In addition to directing research beyond the limits of the listed courses below, the members of the instructing staff stand ready to supervise original work in the fields here noted: Professor SAMPSON, drama; Professor STRUNK, Old English; Professor PRESCOTT, relations of English and American literature; Professor NORTHUP, Middle English romances; Professor COOPER, the earlier literature of the nineteenth century; Professor ADAMS, Elizabethan drama; Dr. MONROE, Middle English; Dr. COX, Celtic; Dr. BAILEY, Victorian poetry; Mr. KIRK, Victorian prose.

Introductory Course; Nineteenth Century Prose; Advanced Composition; Argumentative Composition; Teachers' Course; Play Writing; Nineteenth Century Poetry; Greek and Latin Classics in Translation.

Old English. Dr. MONROE.

Middle English. Professor STRUNK.

Linguistics. Dr. MONROE.

Milton. Dr. BAILEY.

Ballads. Dr. COX.

Shakespeare. Professor STRUNK.

English Drama to 1642. Assistant Professor ADAMS.

American Literature. Assistant Professor PRESCOTT.

Dante in English. Assistant Professor COOPER.

Victorian Poetry. Assistant Professor NORTHUP.

Methods and Materials of English Study. Assistant Professor COOPER.

Arthurian Legends. Assistant Professor NORTHUP.

Dramatic Structure. Professor SAMPSON.

Tudor-Stuart Drama. Assistant Professor ADAMS.

Irish Epic. Dr. COX.

Layamon's Brut. Dr. MONROE.

Seminary.

Principles of Criticism. Assistant Professor COOPER.

Epic and Romance. Assistant Professor NORTHUP.

Old English Phonology, Syntax, and Prosody. Professor STRUNK.

American Literature. Professor PRESCOTT.

Dramatic Theory. Professor SAMPSON.

PHILOSOPHY AND PSYCHOLOGY

Professors: J. E. CREIGHTON, Logic and Metaphysics; E. B. TITCHENER, Psychology; FRANK THILLY, Philosophy; W. A. HAMMOND, Ancient and Medieval Philosophy; ERNEST ALBEE, Philosophy; I. M. BENTLEY, Psychology.

Instructors: L. R. GEISLER, Psychology; A. H. JONES, Philosophy; E. L. SCHAUB, Philosophy.

The subjects of philosophy and psychology are grouped in the The Susan Linn Sage School of Philosophy. This school owes its existence to the generosity of the late Henry W. Sage, who, in addition to endowing the Susan Linn Sage philosophical professorship, made a further gift of \$200,000, for the purpose of providing permanently at Cornell University for philosophical instruction and investigation of the most varied kind and of the highest order. The endowments of the School of Philosophy enable it to secure whatever material facilities are required for the successful prosecution of philosophical studies and research. The more important philosophical and psychological journals, American and foreign, are received by the Library, which is also well equipped with philosophical and psychological works, and is particularly rich in literature relating to Plato, Spinoza, and Kant.

The larger part of the work of the Sage School is adapted to the needs of graduates of this and other institutions who are preparing themselves to be teachers or investigators in philosophy and in allied fields of study. A student who has made a special study of philosophy during his junior and senior years may still take a graduate course of three years' work with history of philosophy, logic and metaphysics, ethics, or psychology, as his major subject. For the encouragement of higher studies and research in every branch represented by the School of Philosophy, there have been established three fellowships of the annual value of \$500 each, and six scholarships of the annual value of \$300 each. Of these, one fellowship and one scholar-

ship are regularly assigned to psychology. Applicants for fellowships and scholarships should therefore state definitely whether their major subject will be in one of the several branches of philosophy or in psychology.

The research department of the psychological laboratory in Morrill Hall contains fifteen rooms, two of which are used as the private laboratories of the officers of instruction, one as a seminary room, and one as a workshop; the remainder are at the disposal of students for advanced work. The experimental rooms are furnished, as required, with gas, water, and the direct and alternating electric current; they are also connected by an elaborate wiring system, so that two or more rooms may be employed together in a single investigation. There are two dark chambers. The workshop is adequately equipped, and a skilled mechanic is in the service of the department. The laboratory possesses standard instruments of precision for all the principal modes of experiment upon human consciousness, and is especially rich on the side of acoustics. Materials are available, or can be supplied, for the study of certain problems in comparative psychology. The equipment is undergoing continual improvement, and special apparatus required for research is at once constructed or procured. The results of investigations pursued in the laboratory are published in the *American Journal of Psychology*.

Graduate students further have the use of the unusually complete sets of demonstrational and teaching apparatus contained in the demonstrational laboratory (Goldwin Smith Hall) and the undergraduate laboratory (Morrill Hall).

Professor Titchener devotes his entire time to the conduct of the graduate laboratory.

The Philosophical Seminary Room in the Library Building is provided with complete sets of the leading philosophical journals, lexicons, and other books of reference, and the more important works in the several branches of philosophy and psychology. The current numbers of the philosophical journals are also to be found in the room. Liberal provision is made for the constant growth of this special library.

The *Philosophical Review*, established by the University, is a bi-monthly journal devoted to the interests of philosophy, embracing under that title logic, metaphysics, ethics, psychology, æsthetics, and philosophy of religion. It is issued under the editorship of Professor J. E. Creighton, and has now completed its nineteenth year of publication. Although supported by private endowment, it is not the organ of any institution or of any philosophical school, but by the terms of the subsidy is an absolutely free organ of contemporary philosophy. Graduate students assist by contributing summaries of periodical literature for publication in the *Review*, and are thus kept in close touch with the results of recent investigations in their several departments of work. In addition to this, graduate students have contributed a number of original articles to the *Review*.

Under the title of *Cornell Studies in Philosophy*, a series of monograph studies is published from time to time as representative of the work done by graduate students in philosophy. These monographs are issued under the editorial supervision of the professors of philosophy, and consist mainly of doctoral dissertations of high quality. The series furnishes also a

channel for the publication of research other than that of the thesis. Eight monographs have been issued in the series.

The School is devoted to the free and unhampered investigation of truth in regard to all those questions of human inquiry which are embraced by logic, metaphysics, psychology, ethics, and the history and philosophy of religion. In the courses of instruction are represented the chief branches and problems of philosophy. Work devoted to the thesis for the doctorate is intended to secure the maximum of specialized training and the power of independent inquiry and statement of results. In all divisions of philosophy particular stress is laid upon the historical study of philosophical ideas as the best means of securing a comprehensive grasp of fundamental problems and values.

Introduction to Philosophy; Elementary Psychology; Logic; The Fine Arts; Ethics; Moral Ideas and Practice; Ancient and Medieval Philosophy; The Relations between Philosophy and Literature during the Nineteenth Century; Platonism; The Theory of Evolution; Origin and Development of Religious Ideas; Problems in the Philosophy and Psychology of Religion.

Experimental Psychology. Assistant Professor BENTLEY and Dr. GEISSLER.

History of Philosophy. Professor CREIGHTON.

Reading of German Psychology. Dr. GEISSLER.

Rapid Reading of German Philosophy. Professor HAMMOND.

History of Ancient and Medieval Philosophy. Professor HAMMOND.

Types of Metaphysical Theory. Professor CREIGHTON.

Philosophical Applications and Results. Professor CREIGHTON.

History of Ethics, Ancient, Medieval, and Renaissance. Professor HAMMOND.

History of Modern Ethics. Professor ALBEE.

General Psychology. Assistant Professor BENTLEY.

Psychology of Special Actions. Dr. GEISSLER.

Psychology of the Intellectual Functions. Dr. GEISSLER.

Advanced Psychological Laboratory. Assistant Professor BENTLEY and Dr. GEISSLER.

Comparative Psychology. Assistant Professor BENTLEY.

The Ethics of J. S. Mill, Spencer, Sidgwick, Kant, and Schopenhauer. Professor THILLY.

The Republic of Plato, Greek text. Professor HAMMOND.

Aristotle's Ethics, Greek text. Professor HAMMOND.

Thomas Aquinas. Professor HAMMOND.

Empiricism and Rationalism in the Seventeenth and Eighteenth Centuries. Professor ALBEE.

The Critical Philosophy of Kant. Professor ALBEE.

Early Rationalism: Spinoza and Leibniz. Professor ALBEE.

German Pessimism, with special reference to Schopenhauer. Professor ALBEE.

Problems and Methods in Recent Philosophy. Professor ALBEE.

Logical Theory: A Study of Bradley, Bosanquet, Dewey, and others. Professor ALBEE.

Modern Idealistic Theories of Ethics. Professor THILLY.

Seminary in Ethics. Professor THILLY.

Seminary in Logic and Metaphysics. Professor CREIGHTON.

Seminary in Ancient and Medieval Philosophy. Professor HAMMOND.

Seminary in Psychology. Assistant Professor BENTLEY.

Research in Psychology. Professor TITCHENER.

EDUCATION

Professors: CHARLES DEGARMO; G. M. WHIPPLE.

The educational museum contains collections illustrating the work done in various school grades, statistical charts, a full assortment of text-books for American and German schools, including a relatively complete collection of the texts used for industrial training in the German continuation schools, an extensive high-school and college exhibit of the raw materials of commerce, a kindergarten exhibit, and other appropriate material.

The educational laboratory has a collection of apparatus for demonstration, and of instruments of precision for research in connection with school hygiene, the experimental study of school children (with special reference to the conduct of physical and mental tests), and the psychological phases of education in general. This equipment is constantly being enlarged and apparatus needed for special investigations is at once procured.

Graduate students selecting education as their major subject will be expected to take from one-half to two-thirds of their work in the studies that are fundamental to an adequate mastery of educational theory and practice. These fall naturally into two groups, the philosophical and the social. The philosophical studies include psychology, ethics, and the history of philosophy; the social studies include political, social, and economic science. All graduate study in education presupposes familiarity with the history and principles of education and with educational psychology. Candidates for advanced degrees whose preparation in this respect is inadequate must make up this deficiency by taking the appropriate undergraduate courses.

Principles of Education; Present Problems in Education; History of Education; Educational Psychology; School Hygiene; The Education of Defectives and the Feeble-Minded; Elementary Education.

Mental Development. Assistant Professor WHIPPLE.

School Administration. Professor DEGARMO.

Philosophy of Education. Professor DEGARMO.

Experimental Study of School Children. Assistant Professor WHIPPLE.

Ethical Training in Secondary Schools. Professor DEGARMO.

Seminary for Experimental Investigation. Assistant Professor WHIPPLE.

Seminary for the Science and Art of Education. Professor DEGARMO and Assistant Professor WHIPPLE.

HISTORY AND POLITICAL SCIENCE

The subjects of history and political science have been united since 1887 in the President White School of History and Political Science, which bears the name of the first president of the University, in especial recognition of the gift of his valuable collection of historical literature to the University Library.

The aims of the President White School are threefold: first, the advancement of knowledge by investigation and publication in the fields of history, economics, politics, jurisprudence, and social science; second, the training of scholars and teachers in these departments of study; third, the training of men and women for the public service, for business, and for professions such as law, journalism, and philanthropy.

The School issues the Cornell Studies in History and Political Science, of which three volumes have appeared.

1. Money and Credit Instruments in their Relation to General Prices. By Edwin Walter Kemmerer, Ph.D., Professor of Economics and Finance in Cornell University. First edition, 1907. Second edition, 1909.
2. Sargon of Assyria. By Albert Ten Eyck Olmstead, Ph.D., Instructor in History in the University of Missouri. 1908.
3. The Judicial Work of the Comptroller of the Treasury. By Willard E. Hotchkiss, Ph.D., Dean of the School of Commerce, Northwestern University. 1910.

HISTORY

Professors: G. L. BURR, Medieval History; NATHANIEL SCHMIDT, Oriental History; C. H. HULL, American History; R. C. H. CATTERALL, Modern European History; H. A. SILL, Ancient History; J. P. BRETZ, American History.

A graduate student in history should have a sufficient knowledge of general history and of geography. He should be able to speak and write good English. He should have a reading knowledge of French, of German, and of any other language necessary for the thorough study of his special subject. It is highly desirable that he should have had the necessary linguistic training as an undergraduate; but deficiencies in this respect may sometimes be made up after entering upon graduate work.

The University Library contains some seventy or eighty thousand volumes dealing with history. In large part these are to be found in the room known as the White Historical Library. Graduate students have immediate access to this rich group of books which, with its many special collections, offers every facility for training in the methods of minute and exhaustive research. The historical seminary rooms in the Library building are amply furnished with atlases, cyclopedias, dictionaries, bibliographies, and other useful works of reference, and afford easy access to the shelves of the library proper.

It has from the outset been the policy of the University, while providing adequately for the symmetrical growth of the library, to acquire the richer private collections of books which eminent scholars have through a lifetime

of study, built up as their tools of research. Thus, for the study of Oriental history, Cornell has been endowed with the Eisenlohr collection on the history of Egypt and that of President White on the history of Palestine. For the study of the Graeco-Roman world, it acquired that of Charles Anthon. For the Middle Ages, it has notable bodies of books on the birth of the Papal state, on the rise of the Carolingian empire, and, in general, on the relations of Church and State. For the Renaissance, it can boast the unrivaled Fiske collections on Dante and Petrarch and the world of their time. For the age of the Reformation, for the history of superstition and persecution (notably for Inquisition and Index, for the story of witchcraft, for the beginning of the sciences, for the rise of tolerance), it is equipped with the riches of the President White Library; and for the study of the French Revolution, that library has no equal on this side of the Atlantic, if anywhere outside of France. For the history of America, the University possesses the library of the historian Jared Sparks, with the May collection on American slavery, and the White collection on the Civil War. Professor Goldwin Smith enriched it with his working library of English history; it obtained that of Professor Tuttle on Prussia; from Professor Fiske came one singularly complete on Iceland. In a multitude of narrower fields it has been found possible to gather for the special student materials for exhaustive research. Many of these collections are endowed with special funds for their increase; and all have been steadily built up with an eye to the needs of the mature student of history.

Two fellowships and a scholarship are annually awarded to graduate students of history. The President White Fellowship in Modern European History has a value of \$600. It may be granted as a traveling fellowship. The Fellowship in American History amounts to \$500. The Graduate Scholarship in History amounts to \$300. There are five assistantships in history, which are filled preferably by the appointment of graduate students.

The teachers and graduate students of history have formed a History Club, which meets once a month for the reading and discussion of papers on historical topics and for social intercourse.

Ancient History

Ancient History.

Greek History in the Fifth and in the Fourth Century. Professor SILL.

The Macedonian Monarchies and the Hellenistic Age. Professor SILL.

Roman History, the Revolutionary Period. Professor SILL.

The Roman Empire from Augustus to Justinian. Professor SILL.

Roman Law. Professor SILL.

Seminary in Greek and Roman History. Professor SILL.

History of Asia; History of Africa. Professor SCHMIDT. See under Semitics.

Medieval History

The Middle Ages (300-1300 A. D.).

Renaissance and Reformation (1300-1600). Professor BURR.

The Rise of Tolerance. Professor BURR.

Medieval Life. Professor BURR.

Seminary in Medieval History. Professor BURR.

Canon Law. Professor BURR.

Modern European History

English History.

History of Modern Europe (1600-1815). Professor CATTERALL.

English Constitutional History. Professor CATTERALL.

The French Revolution. Professor CATTERALL.

Germany in the Nineteenth Century. Professor CATTERALL.

Italy in the Nineteenth Century. Professor CATTERALL.

Seminary in Modern European History. Professor CATTERALL.

American History

American History from the Period of Discovery to 1815; American History, 1815-1892; Economic History of the United States (1600-1890).

Constitutional History of the Colonies and States to 1780. Professor HULL.

Constitutional History of the United States since 1860. Professor BRETZ.

The Jeffersonian System, 1800-1815. Professor HULL.

The Settlement of the Middle West. Professor BRETZ.

History of Religious Organizations in the Middle West. Professor BRETZ.

Seminary in American History. Professors HULL and BRETZ.

General Courses

The Sciences Auxiliary to History (their aims, methods, literature, and use to history). Professor BURR.

Historical Geography. Professor BURR.

Paleography and Diplomatics. Professor BURR.

Historical Method (the nature, scope, materials, and method of history). Professor BURR.

The Teaching of History. Professor BURR, with aid from his colleagues.

Introduction to the Literature of History (a general survey, period by period, of the sources and literature of history). Professors SCHMIDT, SILL, BURR, CATTERALL, HULL, and BRETZ.

POLITICAL SCIENCE

Professors: J. W. JENKS, Economics and Politics; W. F. WILLCOX, Economics and Statistics; F. A. FETTER, Economics and Distribution; E. W. KEMMERER, Economics and Finance; JOHN BAUER, Economics.

Instructors: W. E. LAGERQUIST, Economics and Statistics; J. R. TURNER, Economics; R. S. SABY, Economics; A. P. USHER, Economics.

The political science group in the President White School of History and Political Science consists of four divisions, each of which treats a portion of the subject of economics and deals in addition with some one branch of political science.

These divisions aim to bring their work into close relationship with social, political, and business life. The members of the faculty seek to keep in touch with the practical as well as with the purely scientific aspects of the problems treated, and have among their interests the preparation of students for positions in business and public service.

In economics and politics, many theses for the doctor's degree, such as that on the Committee System and that on the Judicial Work of the Comptroller of the Treasury, have dealt with the actual routine work of politics or administration; others, like that on the Street Railways of New York City, have examined the relations between certain lines of business and politics; and others, like that on the Finances of New York City, have dealt historically with administrative work.

In economics and statistics, work is offered mainly in statistics but to some degree also in the less definite field of social science. The statistical method has been found of especial service, both in developing a scientific and judicial attitude, and in bringing out many facts about social life not discoverable in any other way.

In economics and distribution, several courses are offered dealing with modern efforts for social betterment. A course for graduates only deals with important contributions of contemporary economists to the theory of distribution, which in some form underlies every project of social reform. Other courses treat of the legal and economic aspects of the labor problem, the projects of industrial insurance, arbitration, etc.; of the history, theory, and present position of the socialist parties; and of criminology and charity, especially in relation to the welfare of the masses.

In economics and finance, courses are offered dealing with money and banking, public finance, corporate finance, accounting, insurance, and investments. Especial attention is given to the subjects of currency, taxation, and corporate finance. In 1911-1912, a graduate course will be devoted to the subject of proposals for a central bank for the United States in the light of European experience.

This group uses two laboratories and two class rooms on the second floor of Goldwin Smith Hall in close proximity to each other and to the four division offices and the one general office of the group, an arrangement which has greatly facilitated intercourse between teachers and graduate students as well as between graduate students themselves. At the division offices numerous publications in politics and in economic legislation and business, such as market letters of leading brokers and technical

business journals, are accessible to advanced students. The laboratories for classes in statistics, finance, and charities are supplied not only with standard and current books dealing with these subjects but also with various mechanical devices for simple statistical processes and for securing a graphic and effective presentation of results. A selected series of lantern slides illustrates the social and economic conditions underlying various forms of political organization, the racial types of mankind and their distribution, the nature and relations of many statistical and monetary phenomena, and the problems of philanthropy and of crime.

Candidates for advanced degrees should have or should acquire at once a reading knowledge of at least two foreign languages, preferably French and German, and should have had courses in economics, social science, and political institutions.

Two assistantships, each yielding \$150 and tuition; three fellowships, two yielding \$500 each and one yielding \$600; and one teaching assistantship yielding \$500 and tuition are filled each spring.

Elementary Economics; Political Institutions; Comparative Politics; Elementary Social Science; Corporation Economics; Vocational Training and Practice; Principles of Business Management; Methods of Modern Philanthropy; Financial History of the United States; Railway Transportation; Science of Accounts; Insurance; Investments; Municipal Government in Europe; Municipal Government in the United States; International Law; Commerce and Commercial Policies; The Principles of Politics; The Practice of Politics.

Labor Problems. Professor FETTER.

Social Reforms. Professor FETTER.

Modern Questions in International Politics. Professor JENKS.

Money, Credit and Banking. Professor KEMMERER.

Economic History of England since 1750. Dr. USHER.

Public Finance. Professor KEMMERER.

Demography or Population Statistics. Professor WILLCOX.

Economic Statistics. Professor WILLCOX.

Advanced Statistics. Professor WILLCOX.

Ethnology. Professor WILLCOX.

Human Migrations. Professor WILLCOX.

The Modern Theory of Distribution. Professor FETTER.

The Principles of Politics. Professor JENKS.

Currency and Banking Reform in the United States. Professor KEMMERER.

Research in Labor Problems. Professor FETTER.

Research in Finance. Professor KEMMERER.

Research in Politics and Economic History of the United States. Professor JENKS.

Research in Statistics. Professor WILLCOX.

Research in Philanthropy. Professor FETTER.

General Seminary. Professors JENKS, WILLCOX, FETTER, and KEMMERER.

MATHEMATICS

Professors: JAMES McMAHON; J. H. TANNER; J. I. HUTCHINSON; VIRGIL SNYDER; F. R. SHARPE; W. B. CARVER; ARTHUR RANUM.

Instructors: D. C. GILLESPIE; C. F. CRAIG; F. W. OWENS; J. V. MCKELVEY; L. L. SILVERMAN; W. A. HURWITZ; E. J. MILES.

The graduate work provides instruction in the principal branches of mathematics and furnishes preparation and material for independent investigation. Only a portion of the whole field can be covered by the courses given in a single year. The courses are therefore changed from year to year in order to meet the needs of the students.

In addition to the regular instruction, individual guidance and advice are offered to any student who wishes to follow a particular line of inquiry.

The equipment in mathematics consists of a collection of about three hundred models, including: plaster models of the quadric and cubic surfaces, of several forms of the Kummer surface, of the cyclides, of surfaces of centers of quadrics, and of minimum surfaces; plaster models illustrating positive, negative, and parabolic curvature, and constant measure of curvature; plaster models illustrating the theory of functions, among them models of simply and multiply connected surfaces and of several forms of Riemann's surfaces, and models representing the real parts of algebraic, exponential, logarithmic, and elliptic functions; wooden and glass models of crystals and polyhedra; wire and thread models of twisted curves and ruled surfaces, and skeleton frames for minimum surfaces.

The University Library has a large collection of books on pure and applied mathematics, including collected works of mathematicians, complete sets of all the important mathematical journals, transactions and other publications of scientific societies, and doctoral theses from the leading American and European universities.

The Oliver Mathematical Club, composed of teachers and advanced students, meets weekly and has for its object the systematic presentation, by the members, of some specified mathematical theory of recent development, and of reports on noteworthy articles in current journals and on the results of special reading and investigation.

Solid Geometry; Advanced Algebra; Trigonometry; Analytic Geometry and Calculus for Engineers; Analytic Geometry and Calculus for Students in Arts; Analytic Geometry and Differential Calculus; Integral Calculus.

Teachers' Course in Algebra and Geometry. Professor TANNER.

Differential Equations. Dr. OWENS.

Elementary Mechanics. Professor SHARPE.

Descriptive and Projective Geometry. Professor SNYDER.

Advanced Analytic Geometry. Dr. MCKELVEY.

Theory of Equations. Dr. SILVERMAN.

Infinite Series and Products. Dr. SILVERMAN.

Advanced Calculus. Dr. MILES.

Conjugate Coordinates. Professor CARVER.

Theory of Probabilities. Professor McMAHON.

Algebraic Curves. Dr. CRAIG.

Theory of Numbers. Professor CARVER.

Advanced Theory of Functions. Professor HUTCHINSON.

Theory of Functions of a Real Variable. Dr. GILLESPIE.

Differential Equations of Mathematical Physics. Dr. HURWITZ.

General Mathematical Physics. Professors McMAHON and SHARPE.

PHYSICS

Professors: F. L. NICHOLS; ERNEST MERRITT; FREDERICK BEDELL; J. E. TREVOR; J. S. SHEARER; G. S. MOLER; ERNEST BLAKER.

Instructors: W. J. FISHER; C. A. PIERCE; R. C. GIBBS; F. K. RICHTMYER; R. C. RODGERS; F. A. MOLBY; A. A. SOMERVILLE; A. S. GALAJIKIAN; C. C. MURDOCK; H. E. HOWE; H. O. TAYLOR; M. M. GOLDBERG; A. H. FORMAN.

In the subject of physics, opportunities are offered for study and investigation in theoretical physics and in various experimental branches of the science.

The facilities for radiometric and spectrophotometric work, for the investigation of the properties of matter throughout a very wide range of temperatures, in the application of photographic methods to problems in experimental physics, and in electricity, especially for the study of alternating current phenomena, etc., are exceptionally good.

Forty rooms in Rockefeller Hall are set aside for advanced workers. Research is organized as a distinct division with its own equipment, stock and apparatus room, well-equipped workshop for the use of graduate students, complete appliances for the production and handling of gases, including generators, low and high pressure storage tanks, compressors and power driven vacuum pumps, etc. An instrument-maker's shop with two mechanics is devoted solely to the construction and repair of apparatus.

During the year 1911-12, Professor NICHOLS will direct the work of graduate students in experimental physics and particularly in radiation and luminescence; Professor MERRITT, in theoretical and experimental physics, particularly in electricity and magnetism and problems connected with luminescence; Professor BEDELL, in applied electricity, theoretical and experimental, and particularly in alternating current phenomena; Professor SHEARER, in theoretical and experimental physics and particularly in work requiring the production and measurement of high and low temperatures; Professor TREVOR, in the theory of thermodynamics; Professor MOLER, in work involving the use of photography; Professor BLAKER, in sound and illumination.

Introductory Experimental Physics; Introductory Physics; General Physics; Introductory Physical Experiments; Physical Experiments.

Heat. Assistant Professor BLAKER.

Light. Assistant Professor BLAKER.

- Electricity and Magnetism. Assistant Professor BLAKER.
 Properties of Matter. Assistant Professor BLAKER.
 Sound. Assistant Professor BLAKER.
 Advanced Laboratory Practice. Assistant Professor BLAKER.
 Advanced Photography. Assistant Professor MOLER.
 Alternating Currents. Professor BEDELL.
 Electrical Laboratory Practice. Professor BEDELL and Dr. PIERCE.
 Advanced Course in Electrical Laboratory. Professor BEDELL and Dr. PIERCE.
 Design and Construction of Apparatus for Research. Assistant Professor MOLER.
 Recent Advances in Experimental Physics. Professor MERRITT.
 The Electric Transmission of Intelligence. Professor NICHOLS.
 Primary and Secondary Batteries. Professor NICHOLS.
 Photometry and the Physics of Illumination. Professor NICHOLS.
 Photometry. Dr. RICHTMYER.
 Theory of Light. Professor SHEARER.
 Theory of Heat. Professor SHEARER.
 Reading Course on the Electro-magnetic Wave Theory. Professor SHEARER.
 The Application of Mathematics to Physics. Professor SHEARER.
 Physical Seminary. Professor NICHOLS.
 Theoretical Physics. Mechanics and Thermodynamics. Professor MERRITT.
 Theoretical Physics. Electricity and Magnetism. Professor MERRITT.
 Thermodynamics. Professor TREVOR.
 The History of Mechanics. Dr. FISHER.
 The Kinetic Theory of Gases. Dr. FISHER.

CHEMISTRY

- Professors: L. M. DENNIS, Inorganic Chemistry; W. R. ORNDORFF, Organic and Physiological Chemistry; W. D. BANCROFT, Physical Chemistry; E. M. CHAMOT, Sanitary Chemistry and Toxicology; G. W. CAVANAUGH, Agricultural Chemistry; A. W. BROWNE, Inorganic and Analytical Chemistry.
 Instructors: G. R. WHITE; H. W. REDFIELD; G. E. F. LUNDELL; F. F. SHETTERLY; E. H. NICHOLS; T. W. B. WELSH; B. J. LEMON; L. J. CROSS; C. C. HEDGES.

The chemical laboratory, Morse Hall, contains a floor space of over 90,000 square feet. It is provided with four lecture rooms, having a total seating capacity of five hundred and fifty-four, and with four recitation rooms. For elementary work in inorganic chemistry and in qualitative and quantitative analysis, there are three large laboratories containing in the aggregate places for about twelve hundred and fifty students working in sections. In addition to these, there are two rooms for organic chemistry, a special laboratory for microchemical analysis, one for bacteriological work in connection with the analysis of water and foods, one room for distillation in water and food

analysis, three rooms for assaying, two for gas analysis, a fire-proof room for work with highly inflammable substances, a laboratory for combustion analysis, a hydrogen sulphide room connected with strong fan exhaust, an electric furnace laboratory, a large room for advanced inorganic chemistry, a room for spectroscopic chemical analysis, a large laboratory for elementary work in physical chemistry, one for electrochemistry, one for advanced work in agricultural chemistry, and a number of rooms devoted exclusively to research. Distilled water is conducted in block tin pipes to all the more important rooms on each floor from a tin-lined tank in the upper story of each building. Air blast is conducted wherever required from a high pressure blower in the basement. The buildings are supplied with an alternating current of 2200 volts and with two direct current circuits of 500 and 110 volts. Currents for electrochemical analysis and synthesis are furnished by storage batteries. With the aid of a motor generator, low voltage direct currents up to 2000 amperes may be obtained. The chemical library contains complete sets of the more important journals, and is fully supplied with works of reference and with the standard books on chemistry and allied subjects.

A graduate student that desires to take either a major or a minor subject in chemistry may select any one of the following six branches: inorganic chemistry, analytical chemistry, organic chemistry, physical chemistry, sanitary chemistry, agricultural chemistry. Under the present procedure, both the major subject and the one minor subject required for the degree of Master of Arts or the major subject and the two minor subjects required for the degree of Doctor of Philosophy may be selected from the six divisions mentioned above, but it is desirable that candidates for the degree of Doctor of Philosophy select at least one minor subject outside of chemistry.

A graduate student that desires to take a minor subject in chemistry with some subject other than chemistry as the major subject will be required to offer introductory inorganic chemistry and elementary qualitative and quantitative analysis as preliminary to his graduate work. The work upon his minor subject in chemistry may be taken in any branch of the subject that he is qualified to pursue, and may comprise advanced courses selected from the subjoined list, with approval of his special committee.

Candidates for the degree of Master of Arts or for that of Doctor of Philosophy with the major subject in chemistry will be expected to have a reading knowledge of French and German and will be required to offer as preliminary to their graduate work in chemistry the following subjects: introductory inorganic chemistry, elementary qualitative and quantitative analysis, advanced quantitative analysis, spectroscopic chemical analysis, gas analysis, elementary organic chemistry, microchemical methods, and elementary physical chemistry. Courses in these subjects, if taken in another university, will be accepted if they are substantially equivalent to the courses offered at Cornell. Graduate students entering from other universities may take during their residence for the advanced degree such of the above courses as they have not already pursued. If a graduate student lacks at entrance several of these preliminary courses longer residence may be necessary. More advanced courses may be elected from the appended list, with the approval of the special committee.

Introductory Inorganic Chemistry; Qualitative and Quantitative Analysis; Qualitative Analysis; Quantitative Analysis, Elementary Course.

Quantitative Analysis. Advanced course. Dr. LUNDELL and Messrs. MARSH and LOHR.

Quantitative Analysis. Advanced Lectures. Dr. LUNDELL.

Spectroscopic Chemical Analysis and Colorimetry. Lectures and Laboratory. Dr. SHETTERLY and Messrs. MILLER and A. R. HITCH.

Assaying. Lectures and laboratory. Dr. LUNDELL and Mr. WALKER.

Qualitative and Quantitative Gas Analysis. Lectures. Dr. SHETTERLY.

Technical Gas Analysis. Laboratory practice. Dr. SHETTERLY and Messrs. MILLER and A. R. HITCH.

Gas Analysis, Advanced Course. Laboratory practice. Professor BROWNE and Dr. SHETTERLY.

Organic Chemistry. Professor ORNDORFF, Mr. NICHOLS, and Messrs. E. F. HITCH and CONKLIN.

Organic Chemistry. Lectures. Professor ORNDORFF and Mr. E. F. HITCH.

Elementary Organic Chemistry. Mr. NICHOLS and Mr. CONKLIN.

Special Chapters in Organic Chemistry. Professor ORNDORFF.

Advanced Organic Chemistry. Laboratory practice. Professor ORNDORFF and Mr. NICHOLS.

The Coal Tar Dyestuffs. Professor ORNDORFF.

Stereochemistry. Professor ORNDORFF.

Methods of Organic Analysis. Laboratory practice. Professor ORNDORFF and Mr. NICHOLS.

Inorganic Chemistry. Advanced course. Professor DENNIS.

Inorganic Chemistry. Laboratory practice. Professor DENNIS and Mr. ANDERSON.

Selected Topics in Advanced Inorganic Chemistry. Professor BROWNE.

Chemistry of Gases. Lectures. Professor BROWNE.

Introductory Physical Chemistry. Lectures. Dr. WHITE.

Physical Chemistry Laboratory. Dr. WHITE and Mr. BRIGGS.

Advanced Physical Chemistry. Professor BANCROFT.

Colloid Chemistry and Photochemistry. Professor BANCROFT.

Theoretical Electrochemistry. Professor BANCROFT.

Applied Electrochemistry. Lectures. Professor BANCROFT and Messrs. BENNETT and KOERNER.

Applied Electrochemistry. Laboratory. Messrs. BENNETT and KOERNER.

Applied Electrochemistry. Laboratory. Professor BANCROFT and Messrs. BENNETT and KOERNER.

Advanced Laboratory Practice. Professor BANCROFT, Dr. WHITE, and Messrs. BENNETT and KOERNER.

Microchemical Methods. Laboratory. Professor CHAMOT and Dr. RATHJEN.

Microchemical Analysis. Elementary course. Professor CHAMOT and Dr. RATHJEN.

Microchemical Analysis. Advanced course. Professor CHAMOT.

Foods, Beverages, and Food Accessories. Professor CHAMOT.

Food Analysis. Professor CHAMOT and Mr. REDFIELD.

Microscopical Examination of Foods. Professor CHAMOT.

Potable Water. Professor CHAMOT.

Water Analysis. Professor CHAMOT, Mr. REDFIELD and Dr. RATHJEN.

Toxicology. Professor CHAMOT.

Toxicology. Laboratory. Professor CHAMOT.

Agricultural Chemistry. Lectures and recitations. Professor CAVANAUGH and Messrs. HEDGES, CROSS and RICE.

Agricultural Chemistry. Laboratory Course. Professor CAVANAUGH, and Messrs. HEDGES and RICE.

Agricultural Chemistry, Advanced Course. Lectures. Professor CAVANAUGH.

Agricultural Analysis. Laboratory practice. Professor CAVANAUGH and Mr. CROSS.

Agricultural Analysis. Laboratory practice. Professor CAVANAUGH and Mr. CROSS.

Dairy Chemistry. Professor CAVANAUGH.

Advanced Agricultural Analysis. Professor CAVANAUGH.

Seminary.

Research for Undergraduate Students.

GEOLOGY

Professors: R. S. TARR, Physical Geography; H. S. WILLIAMS, Geology; HEINRICH RIES, Economic Geology; G. D. HARRIS, Paleontology and Stratigraphic Geology; A. C. GILL, Mineralogy and Petrography; W. M. WILSON, Meteorology.

Instructors: O. D. VONENGELN, Physical Geography; C. A. STEWART, Geology; IRVING PERRINE, Geology; J. L. RICH, Physical Geography; S. L. GALPIN, Geology and Mineralogy; H. E. KRAMM, Economic Geology.

Under the general title of geology are included mineralogy, crystallography, petrography, physical geography, meteorology, economic geology, paleontology, stratigraphic geology, dynamic geology.

Mineralogy, Crystallography, and Petrography. The laboratory equipment is especially good in petrographic microscopes, apparatus for chemical and physical investigation of rocks, and apparatus for special crystallographic determinations. There are also collections of rocks and study collections of minerals. The largest of the latter includes the Benjamin Silliman, Jr., collection.

Special graduate courses in this division are not offered but advanced work is adapted to the needs of the individual. Two of the elementary courses are, however, so dependent on a rather advanced knowledge of physics or of chemistry, or of both, that they are to be considered as requiring the maturity of graduates, although open also to undergraduates with sufficient preparation. These are the courses in physical crystallography and petrography. For graduate work in these subjects a student should have chemistry including quantitative analysis, and a good knowledge of general physics. For petrography he should have also general geology.

Physical Geography. The region round about Ithaca abounds in excellent and varied illustrations of physiography, glaciology, and dynamic geology, and consequently abundant opportunity is offered for research. For many years the teachers and advanced students have been engaged in an investigation of the field problems, and these studies will be continued. Besides field work near the University, expeditions are undertaken annually to more distant points, and on these some of the advanced students are usually taken as assistants. The last three expeditions have been to Alaska, and earlier ones were made to Greenland, to Mt. Ktaadn, Me., and to the Adirondacks.

In addition to field work, there are excellent facilities for indoor work. The main laboratory is well equipped with topographic maps and photographs; the collection of relief models is notably complete, and there is an experimental laboratory with apparatus and facilities for carrying on a variety of experiments in the development of land forms, etc. In the main laboratory is a special library of reference works on geographic subjects.

For admission to the advanced courses it is required that the student have a working knowledge of the fundamental principles of the subject and have completed some reading other than text books. These courses serve in the training of students for positions in the better grade of secondary and normal schools, in colleges and universities, in the national geological survey, in exploring expeditions, and for research.

Economic Geology. The work in economic geology is designed to familiarize the student with the origin, occurrence, and distribution of the mineral products of economic value, and also the practical application of geologic principles. The laboratory contains an excellent study collection of economic materials, from the United States, Canada, Mexico, and Europe, including ores, fuels, clays, abrasives, building stones, etc., most of these representing suites of material collected by members of the staff of instruction on geological trips. This collection is supplemented by maps and models. The departmental library contains a number of reports and books on economic geology; and the University Library has an especially full set of works covering this special field.

In addition to the collections, the economic geology laboratory has facilities for general work and research on economic materials, the equipment for clay investigation being especially large.

The work of graduate instruction consists in part of lectures and in part of special work arranged to suit the needs of the individual student. Those students registered for a major subject in economic geology are expected to engage in research, which should preferably be based on field work.

Excursions may readily be taken to the anthracite region of Pennsylvania; the iron, slate, cement and talc region near Easton, Pa.; the magnetite mines of the Adirondacks, etc. Field trips of greater or less length are taken to some of these localities every year.

Paleontology and Stratigraphic Geology. The University is situated in the center of fine exposures of Devonian rocks covering the southern half of the state. In addition to the classical work done by Hall and others in descriptive paleontology for the state, recent work of an intensive kind in elaborating the range and distribution of fossils has been carried on with

Cornell University as a center and with aid of the United States Geological Survey, culminating in the preparation of the Watkins Glen-Catatonk folio, in which for the first time the principles of determining horizons by fossils have been rigidly applied. In the course of preparation of this folio particular attention was given to making full collections of fossils from each zone; numerous generic series are thus provided awaiting elaboration. In the course of this work faunal paleontology with the problems of shifting and recurrence of faunas has opened the way for the study of the larger problems of diastrophism and paleography. The place and the time are thus both favorable for earnest students to find here the facilities for important research in the fields of evolutionary paleontology.

Particular facilities are offered for the application of biometric methods to the interpretation of the evolutionary laws of ancient organisms for which a large amount of Devonian material is now ready for investigation.

In this field, fossils will be investigated in their relations to time and the various problems of evolution, as means for determining and correlating geological formations and reconstructing ancient geographical conditions of the earth's surface.

Facilities for those prepared to engage in research in paleontology and stratigraphic geology are also furnished by the results of four summer expeditions from the University into the Tertiary areas of the Union; eleven seasons' work in Louisiana, two in Arkansas, two in Texas, one in Europe; the results of numerous exchanges; the Newcomb collection (10,000 species) of recent shells; and the exceptional wealth of conchological literature in the geological and the general library. The *Bulletins of American Paleontology*, which is the only paleontological journal in the country, is published in the department.

Elementary Geology; Elementary Physical Geography, or Physiography: lectures, field and laboratory work, and recitations; Geography of North America; Geography of Europe; Physiography of the Lands; Meteorology and Climatology; Crystallography; Mineralogy; Crystal Measurement and Drawing; Blowpipe Determination of Minerals; Building Stones and Clay Products; Practical Geology; Mining of Mineral Deposits.

Glacial Physiography. Professor TARR and Mr. RICH.

Experimental Physiography. Professor TARR and Mr. VON ENGELN.

Seminary. Professor TARR.

Physiographic Investigations. Professor TARR.

Physical Crystallography. Professor GILL.

Petrography. Professor GILL.

Seminary in Mineralogy and Crystallography. Professor GILL.

Advanced or Special Work in Mineralogy, Crystallography, and Petrography. Professor GILL.

Stratigraphic Geology (Paleozoic, Mesozoic-Cenozoic). Professor HARRIS.

Paleontology (Protozoa-Molluscoidea first term, Mollusca to Vertebrates second term). Professor HARRIS.

Research, with conferences. Professor HARRIS.

Geological Evolution of Organisms. Professor WILLIAMS.
General Economic Geology. Professor RIES and Mr. STEWART.
Field Examination of Mineral Deposits. Professor RIES.
Clay Investigation. Professor RIES.
Advanced Economic Geology. Professor RIES.
Economic Geology Seminary. Professor RIES.
Seminary in Foreign Literature. Professor RIES.
Experimental Economic Geology. Mr. STEWART.
Bibliography of Economic Geology. Mr. STEWART.

BOTANY

Professors: G. F. ATKINSON; W. W. ROWLEE.
Instructors: H. B. BROWN; FRED McALLISTER.

The laboratories for advanced work and research are well supplied with apparatus and materials such as microscopes, microtomes, ovens, sterilizers, thermostats, water baths, cameras for photographic and photomicrographic work, culture rooms, electric lantern, etc. The laboratories are directly connected with well-equipped and well-stocked greenhouses. These contain a large assortment of exotic plants, which afford material for illustration and comparison, as well as material for investigation. The greenhouses also afford space for experimental work in plant physiology and morphology, and for the growing of plants under observation. There are excellent facilities for field work in the vicinity of the University.

The University Library is well supplied with the more important periodicals and complete sets of journals relating to botanical science, and a large collection of special works devoted to the various subdivisions of the science, as morphology, histology, physiology, mycology, and the different systematic subdivisions. The works most frequently required for reference are kept in the departmental library.

The botanical seminaries offer opportunity for keeping in touch with the current literature of the subject, and of dealing with the theoretical and practical aspects of the various problems under investigation.

As a prerequisite for graduate work in botany, either as a major or a minor subject, the student should have a thorough knowledge of the fundamental principles of the science. In addition, some prerequisite or supplementary advanced work in morphology, organography, histology, and taxonomy (according to the nature of the subject chosen by the candidate) will be required. When the candidate has not had the desired advanced work it may be taken as preliminary or parallel work with his investigation, by registering in such of these courses as the special committee may determine, but none of the courses indicated will be accepted as meeting the requirement for either the major or the minor subject.

General Comparative Morphology and Physiology of Plants; Special Morphology, Taxonomy, and Ecology of the Higher Plants; Organography and Identification of the Higher Plants; Geographical Botany; Taxonomy and Phylogeny of Angiosperms; Plant Cytology; Comparative Histology of

Plants; Dendrology; Comparative Morphology and Embryology; Mycology; Taxonomy of the Pteridophytes, Bryophytes, and Algæ; Research in Morphology and Embryology; General Taxonomic Survey of the Fungi.

Research in Comparative Morphology and Embryology. Professor ATKINSON and Dr. McALLISTER.

Research in Mycology and Plant Pathology. Professor ATKINSON.

Research in Taxonomy and Phylogeny of the Angiosperms. Professor ROWLEE.

Research in Comparative Histology and Cytology. Professor ROWLEE and Dr. BROWN.

Seminary in Morphology, Embryology, Mycology, Physiology, etc. Professor ATKINSON.

Seminary in Comparative Histology and Taxonomy of the Angiosperms. Professor ROWLEE.

PLANT PHYSIOLOGY

Professor: B. M. DUGGAR.

Instructor: LEWIS KNUDSON.

The laboratories and offices for this subject are on the first floor of the Agronomy Building, College of Agriculture. Supplementary laboratory space and a greenhouse of twenty-five by fifty feet provide additional accommodations for the experimental work. The laboratories are equipped with special reference to the demands of advanced instruction and research. The routine work in the subject is done in one general laboratory, provided with the necessary facilities for the study of the microscopic, the chemical, and the physical aspects of the subject.

The usual microscopic outfits and lockers and much important apparatus required in general physiology are available. A considerable amount of space is devoted to chemical tables, including work tables, titration stands, nitrogen still, reagent and glassware cases, hoods, etc. The departmental equipment includes good balances, one MacKenzie automatic balance for rapidly weighing cultures where transpiration data are taken, recording hygrometers and thermometers, a culture room, steam sterilizers, autoclave, and all small apparatus necessary.

A special laboratory for cytological work has been arranged, with necessary facilities including microscopes, electric incubator, artificial light, etc.

To graduate students desks are assigned in a separate room, which serves as headquarters for their supplies and records. Special effort has been made to give opportunities for individual investigation, particularly in such phases of the work as nutrition, respiration, the relation of plants to climatological and other factors of the environment, the physiology of fermentation, effects of external agencies in heredity, and cell physiology.

The seminars offer to graduate students an opportunity to become familiar with current work in plant physiology and to consider the relation of this work to agricultural practices. At these meetings there are also held general conferences and discussions of opinions or methods not conveniently or appropriately dealt with in the general courses. All graduate

students are required to take part in the work of the seminary and to gain experience in presenting the results of their own research, or in developing opinions respecting the work of others.

In order to pursue graduate work in plant physiology students must have had good scientific preparation. Special training in general biology, botany, or chemistry is essential. In no case, however, may a graduate student enter upon topical work or research without the equivalent of eight hours advanced course work in the subject. Special training in certain aspects of horticultural or agronomic work is also recognized as satisfying a general standard of scientific preparation.

Crop Ecology and Geography; Physiology of the Bacteria; General Plant Physiology.

Advanced Plant Physiology. Professor DUGGAR and Mr. KNUDSON.
Cytology and Cell Physiology. Professor DUGGAR and Mr. KNUDSON.
The Physiology of Fermentation and Enzyme Action. Mr. KNUDSON.
General Seminary. Professor DUGGAR.
Seminary in Cytology. Professor DUGGAR.
Research, General Physiology. Professor DUGGAR.
Research, Cell Physiology. Professor DUGGAR.

HORTICULTURE

Professors: JOHN CRAIG; L. B. JUDSON.

Somewhat exceptional facilities are offered for research in floriculture, olericulture, and the development of plants having economic or æsthetic value. The library equipment consists of a large and steadily increasing collection of works of reference comprising a number of the rarer books of the ancients, an unusually full assortment of the garden herbals of the sixteenth, seventeenth, and eighteenth centuries, and the leading monographs and manuals of modern times, supplemented by complete sets of a large number of the horticultural journals of Europe and America. Students have access to an herbarium comprising about 13,000 cultivated plants.

Floriculture. In this division, the field awaiting the investigator is extensive and practically unworked. Problems in variation, nutrition, culture, and improvement of plants, especially in the whole range of hardy ornamental plants, may be undertaken. The student who undertakes research in floriculture, while not required to devote the summer period to his investigation, may find it advantageous to do so. In addition to field areas now being extended, and 6000 square feet of glass, a new range of glass aggregating some 7000 square feet is now available.

Olericulture. Field and forcing-house facilities in this subject, are being extended as rapidly as possible. The special vegetable growing sections of the state offer unique opportunities for observation and research.

Among the subjects which have formed the basis of theses for master's and doctor's degrees in the past, and which have appeared as Experiment Station Bulletins, are orchard and soil surveys of fruit growing counties. Monographs and systematic studies on several genera of ornamental and use-

ful plants, including pæonia, faba, lathyrus, chrysanthemum, and dahlia, have also been undertaken and published.

In biologic investigation, the following subjects offer excellent material for research: variation of plants; influence of environment on variation; influence of artificial illuminants on plant growth; effects of etherization on germination and plant growth; methods and principles of plant propagation; influence of food on quantity and quality of pollen.

Tropical and Subtropical Horticulture. Professor CRAIG.

Nuciculture. Professor CRAIG.

Literature of Horticulture and Landscape Gardening. Professor CRAIG.

Evolution of Cultivated Plants. Professor CRAIG.

Investigation may be undertaken in the three principal divisions of the horticultural field, or in allied branches, as nature-study, school gardening, and landscape gardening materials.

A seminary is conducted in which all members of the instructing staff take part.

POMOLOGY

Professor: C. S. WILSON.

Instructor: R. D. ANTHONY.

In addition to the laboratory equipment, there is a fifty acre field laboratory devoted to commercial and varietal orchards of the different fruits. As most of these plantings are young the opportunities for research are unusually good. On the grounds are also orchards on Paradise and Doucin stocks and a large collection of seedling stocks used for propagation.

Exceptional facilities are available for studying fruit packing, storing, and marketing. Special work is offered in the study of fruit varieties, adaptation of varieties to soil conditions, and in many other advanced subjects. Each year a large collection of fruit available for graduate use is brought together at the college. Fruit surveys have been made in several counties, and the data secured from these sources afford opportunities for studying the different phases of orchard management in the most important fruit growing sections of the state.

On account of the nature of the work it is very desirable that graduates studying for the master's degree should spend one summer either at the College of Agriculture, or in the field on their special topic. Of graduates working for the doctor's degree this is required.

Elementary Pomology.

Practical Pomology. Professor WILSON.

Bush and Small Fruits. Professor WILSON and Mr. ANTHONY.

Spraying of Fruit Trees. Professor WILSON and Mr. ANTHONY.

Systematic Pomology. Professor WILSON and Mr. ANTHONY.

Advanced Pomology. Professor WILSON.

Research in Pomology. Professor WILSON.

Seminary. Professor WILSON and Mr. ANTHONY.

PLANT-BREEDING

Professors: H. J. WEBBER; A. W. GILBERT; H. H. LOVE.

The equipment for this subject, including laboratory, greenhouses, and gardens, is designed primarily for investigation in experimental evolution. It is, however, available for the use of a limited number of graduate students.

The laboratory is well supplied with suitable microscopes, microtomes, paraffin ovens, etc., for use in histological investigations. It is also equipped with a full photographic outfit and calculating machines for the statistical study of variations. An excellent library dealing with plant-breeding and experimental evolution, and an extensive card catalogue of plant-breeding literature form a part of the equipment. The private libraries of members of the staff, containing many valuable books and pamphlets, are placed at the disposal of graduate students. An herbarium of variations of plants is in process of formation.

Graduate students have the use of three greenhouses, having a total floor space of 2000 square feet, for conducting investigations during the winter months. These houses are fully equipped with all necessary appliances for successful plant culture. They are divided into warm and cool houses, and certain of them have large greenhouses.

Experimental Garden and Farm. A garden of three acres, of good fertility, is available for graduate students in which to grow hybrids and other plants during the summer. For more extensive plantings the department has the use of certain parts of the University farms.

During the first year of his work the candidate for the doctor's degree is expected to spend some time in systematic reading. He is also encouraged to begin work on his minor subjects, with the expectation that the last period of study shall be devoted solely to research. It is expected that the student will complete his minor subjects (chosen outside of plant-breeding) during term time in order that he may spend his summers on his major subject. The completion of many problems in plant-breeding is dependent upon the number of generations of plants grown, and it is very necessary that a student taking this as his major subject start upon his problem during his first year of study. The development of this work will at first be slow and will therefore allow time for the minor subjects and for reading.

It is very desirable that students who are candidates for the doctor's degree should remain in Ithaca during the summer, which is the best time for work in plant-breeding.

General Plant Breeding.

Plant Breeding. Assistant Professor GILBERT and Mr. DORSEY. (Required of graduate students.)

Biometry. Assistant Professor LOVE. (Required of students whose major subject is plant breeding.)

Research. Professor WEBBER, Assistant Professors LOVE and GILBERT.

Seminary. Professor WEBBER, Assistant Professors LOVE and GILBERT. (Required of all graduate students.)

PLANT PATHOLOGY

Professors: H. H. WHETZEL; DONALD REDDICK.

Instructor: M. F. BARRUS.

There is a full equipment of apparatus for carrying on graduate work and research in this subject. There is also provided a number of small individual rooms for graduate students. The equipment includes especially constructed furniture, and the most modern types of microscopes, microtomes, sterilizers, electric incubator, and paraffin bath for the work of teaching and investigation. The phytopathological herbarium includes, besides a local collection, complete sets of a number of the well known exsiccati such as Rabenhorst, Roumeguère, Ravanel, Seymour & Earle, Fungi Columbiana, etc. Considerable space in the new greenhouses is devoted entirely to graduate work and research. The departmental library includes most of the important works on plant pathology, complete sets of the more important journals, and many monographs. The general library contains a complete collection of mycological books.

During the growing season, the department maintains a large number of field laboratories in the more important fruit and crop sections of the state, where members of the staff and graduate students may carry on their investigations. Each of these field laboratories has a complete equipment of apparatus and meteorological instruments necessary for the most careful type of research.

Eight industrial fellowships, established during the past two years by growers or commercial concerns, are now available. These provide exceptional opportunities for investigation, during a continuous period, of problems of great economic importance and scientific value. These fellowships, which are worth from \$500 to \$1500 a year, usually extend over a period of two years, and carry with them sums ranging from \$250 to \$500 to provide for traveling and living expenses, etc., in connection with the work in the field. These are known as temporary industrial fellowships.

Candidates for the doctor's degree are required to spend at least one season in one of the field laboratories, so that they may come in direct contact with the conditions and the practical aspects of the control problems. They are also expected to spend some time in extension work, either at fairs or at institutes.

Candidates for advanced degrees must present evidence of fundamental training in general botany, plant physiology and chemistry, and not later than the beginning of the second graduate year a reading knowledge of French and German.

Plant Pathology; Principles of Plant Disease Control; Diseases of Field and Truck Crops; Diseases of Fruit and Fruit Trees; Diseases of Forcing-house and Florists' Crops; Dendropathology.

Laboratory Methods in Plant Pathology. Professor WHETZEL and Assistant Professor REDDICK.

Etiology of Plant Diseases. Professor WHETZEL, Assistant Professor REDDICK, and Messrs. GREGORY and ———.

Phytopathological Technique. Professor WHETZEL, Assistant Professor REDDICK and Messrs. BARRUS, STEWART, and JENSEN.
Phytopathological Histology. Professor WHETZEL.
Research. Professor WHETZEL, Assistant Professor REDDICK.
Seminary.

VERTEBRATE ZOOLOGY AND MORPHOLOGY OF THE BRAIN

Professor: H. D. REED.
Instructors: A. H. WRIGHT; A. A. ALLEN.

The museum contains representative forms of the various vertebrate groups. In its formation, efforts have been made to obtain specimens from all parts of the world illustrating biologic and evolutionary ideas. The neurologic division of the museum contains about one thousand nine hundred specimens. Among the adult human brains are twelve from well-known educated persons. There are many fetal marsupials from Australia, several entire apes, and about one hundred and fifty hearts from all vertebrate classes.

Of exotic material there are representatives of nearly every family of vertebrates and, in some major groups, of most of the genera.

There have been recorded from this locality sixty-five fishes, seventeen amphibia, twenty reptiles, thirty-nine mammals, and two hundred and fifty-eight birds. The fauna is Transitional, with admixture of Austral and Canadian forms.

Within the radius of one mile are very diverse topographic conditions, the lake, the swamp, several streams, gorges, and waterfalls, hills of varying height with rocky or wooded slopes, forests, and barrens.

Among the facilities for ecologic study may be mentioned the biological station in the swamp at the head of the lake, and the United States Weather Bureau on the campus. The equipment includes the most approved forms of instruments for observation and record, e. g., aneroid barometer, Draper thermograph and psychrograph, whirling hygrometers, maximum-minimum thermometers, clinometer and compass, traverse plane table, etc.

Elementary Zoology; Mammalian Anatomy based upon a study of the cat; Comparative Anatomy of Vertebrates; Comparative Morphology and Evolution of Vertebrates. These courses are preliminary to graduate work.

Systematic Zoology and Ecology. Assistant Professor REED and Mr. ALLEN. (Required of all graduate students.)

Advanced Systematic Zoology. Dr. WRIGHT.

Advanced Ecology. Assistant Professor REED, Dr. WRIGHT and Mr. ALLEN.

Research and Thesis.
Seminary.

ENTOMOLOGY AND GENERAL INVERTEBRATE ZOOLOGY

Professors: J. H. COMSTOCK, Entomology and General Invertebrate Zoology; A. D. MACGILLIVRAY, Entomology and General Invertebrate Zoology; W. A. RILEY, Entomology; J. G. NEEDHAM, Limnology and General Biology; G. W. HERRICK, Economic Entomology C. R. CROSBY, Entomological Investigations.

Students are offered opportunity for advanced work in one or more of the following subjects: morphology of insects, embryology of insects, systematic entomology, invertebrate zoology, economic entomology, and limnology.

Each of the laboratories is well supplied with microscopes and other apparatus necessary for the special work carried on in it. The laboratory of morphology and embryology is especially equipped for histological work. Connected with the laboratory of systematic entomology there is a museum which contains, in addition to many exotic insects, specimens of a large proportion of the more common species of the United States. These have been determined by specialists, and are accessible for comparison. The collection includes many sets of specimens illustrative of the metamorphoses and habits of insects. There is also in this museum a good series of invertebrates other than insects. The advanced work in economic entomology is carried on in large part in an insectary, which is a separate building; a second insectary adjacent to the laboratories is available for other phases of the work. A biological field station at the head of Cayuga Lake, one mile from the campus, and open throughout the year, affords exceptional opportunities for investigations in the biology of freshwater organisms.

The special library of entomology is rich in works on entomology and contains complete sets of all of the more important entomological journals.

General Biology; Morphology of Invertebrates; General Entomology; Elementary Morphology of Insects; Elementary Systematic Entomology. These courses or their equivalents are prerequisite to graduate study.

Advanced Systematic Entomology. Assistant Professor MACGILLIVRAY.
Histology of Insects. Assistant Professor W. A. RILEY.
Economic Entomology. Assistant Professor HERRICK.
Advanced Economic Entomology and Insectary Methods. Assistant Professor HERRICK.

Classification of the Coccidæ. Assistant Professor MACGILLIVRAY.
Morphology and Classification of the Arachnida. Professor COMSTOCK.
Morphology and Development of Insects. Professor COMSTOCK and Assistant Professor W. A. RILEY.

German Entomological Reading. Assistant Professor W. A. RILEY.
Literature of Systematic Entomology. Assistant Professor MACGILLIVRAY.

Embryology of Insects. Assistant Professor W. A. RILEY.
General Limnology. Assistant Professor NEEDHAM.
Research in Limnology. Assistant Professor NEEDHAM.

Animal Parasites and Parasitism. Assistant Professor W. A. RILEY.
 The Relations of Insects to Disease. Assistant Professor W. A. RILEY.
 The Classification of Immature Insects. Assistant Professor MACGILLIVRAY.
 Research in Morphology of Insects. Assistant Professor W. A. RILEY.
 Research in Systematic Entomology. Professor COMSTOCK and Assistant Professor MACGILLIVRAY.
 Research in Economic Entomology. Professor COMSTOCK and Assistant Professor HERRICK.
 Seminary.

HISTOLOGY AND EMBRYOLOGY

Professor: B. F. KINGSBURY.

Instructor: W. A. HILTON.

The equipment for this subject comprises a supply of modern microscopes, camera lucidas, polariscopes, micro-spectroscopes, photo-micrographic cameras, and other special apparatus, in sufficient number to give each student opportunity for learning to use them, and for applying them to any special study in which they are called for. Two projection microscopes are available for blotting paper and wax plate reconstructions. The general and research laboratories are large and are equipped with microtomes, incubators, aquaria, etc. The collection of specimens is large and constantly increasing, and comprises preserved material and embryos as well as embryological and histological series of microscopic preparations of man and mammals and the lower vertebrates.

In addition to the general laboratory, preparation room, and private laboratory rooms for the staff, there is for this subject a large and well lighted advanced laboratory with three small rooms for individual workers, a photomicrographic laboratory and dark room, and a drawing and projection room. A museum of embryological models occupies the center of the advanced laboratory. The rich and varied fauna of the Cayuga Lake region affords favorable opportunity for investigations in the histology and embryology of all the main groups of vertebrates; material for the study of the development of the sheep, cow, and pig is also available. Advanced work in histology and embryology is of necessity individual and is abundantly provided for. In addition advanced students are sometimes recommended to take some one or more of the general courses in the subject. As preliminary to graduate work, students are expected to have had the course in the tissues and one of the following: the organs, special histology, the nervous system and organs of special sense. A year's work in zoology, biology, or physiology may with advantage be combined with advanced work in this subject.

The Tissues; the Organs; Embryology; the Nervous System and Organs of Special Sense.

Advanced Work in Histology and Embryology. Professor KINGSBURY and Dr. HILTON.
 Seminary in Histology and Embryology.

PHYSIOLOGY AND BIOCHEMISTRY

Professors: SUTHERLAND SIMPSON; ANDREW HUNTER; MELVIN DRESBACH.

Instructors: H. W. MAYES; M. H. GIVENS.

For advanced and graduate work in experimental physiology two large laboratories and several smaller rooms are available. Laboratory A on the first floor of Stimson Hall is provided with electro-motor-driven shafting and Sherrington recording drums of the most recent pattern, capable of giving wide ranges of speed. All necessary apparatus is available for graphic work in muscle and nerve physiology, for the investigation of problems in connection with the circulatory and respiratory systems, where objective records are desirable (for example, movements of the excised amphibian and mammalian heart), and for the experimental study of the special senses and the central nervous system. Pendulum and spring myographs are available and several forms of ergograph for the study of muscular and nervous fatigue. Each table is supplied with chronographs and time-recording tuning-forks, induction machines, keys, switches, commutators, etc. Adjoining this laboratory are two smaller rooms; one is being equipped for experimental work on animal heat and body temperature, the other contains a Ludwig kymograph with accessories, and is used primarily for experimental pharmacology. There is also a dark room for photographic and optical work.

Laboratory B is devoted exclusively to research. The equipment includes hæmomanometers and blood-pressure apparatus of the most recent type, and a large Brodie kymograph for continuous smoked paper. A time-recording clock and artificial respiration and chloroform apparatus have just been added. Plethysmographs for recording volume changes in the various bodily organs are provided, and several clock-driven drums are available.

In connection with this laboratory there is a workshop with a skilled mechanic who is capable of making and modifying any kind of apparatus which may be required for special research.

In the basement, on a solid concrete floor, a room is being equipped with galvanometers, capillary electrometers, shunts, rheocords, bridges, and all the other apparatus required in electro-physiology.

The biochemical laboratories on the second floor of Stimson Hall include a general laboratory, and a smaller laboratory for research, both fitted throughout with water, gas, suction pumps, and draught cupboards. Adjoining these are a room for metabolic work, a balance room, a constant temperature room, and storerooms for chemicals and apparatus.

The equipment, which is being steadily increased along many special lines, is suited to the investigation of all kinds of problems connected with the chemistry and functions of the animal body, and includes, besides a large stock of glass apparatus and the ordinary fittings of a chemical laboratory, several metabolism cages, large and small balances, polarimeter, Buchner press, and incubators, also a selection of the most important works of reference. The principal periodicals dealing with physiology and biochemistry are also kept in the building.

Some problem demanding original investigation will be prescribed for each student, who will be guided in his choice of a subject by one of the professors

in charge, due consideration being given to his previous training and to the line of work in which he desires to specialize. Having selected a subject, he will be expected to concentrate his efforts upon it. While the work will be done under the supervision of some one of the members of the teaching staff, and every facility provided in the way of apparatus, etc., the student will be encouraged to rely on his own resources as far as possible, especially in planning and carrying out his experiments. Any special apparatus which he may require or which he may himself design, will be made for him by the laboratory mechanic. It will be expected that the results of his work be embodied in a thesis, and if this is judged to be of sufficient merit it will be published in full or in abstract in some accredited scientific journal.

In addition to this specialized work, in order to give breadth of view, a course of reading will be assigned from time to time. This will be supplemented periodically by a colloquium, at which the current literature will be reviewed, and original papers presented for discussion.

Physiology of the Cell, Muscle, Nerve, Heart and Circulation, Blood and Lymph, and Respiration; Physiology of Digestion, Excretion, Internal Secretion, Animal Heat and Reproduction; Elementary Human Physiology; Experimental Physiology; Laboratory Work in Physiology; Elementary Biochemistry; General Biochemistry; Practical Biochemistry.

Physiology of the Nervous System and Special Senses.
Advanced and Research Work in Physiology.
Advanced and Research Work in Biochemistry.
Seminary in Physiology and Biochemistry.

ANATOMY

Professors: A. T. KERR; J. P. SCHAEFFER.

The laboratories for this subject are situated on the third floor of Stimson Hall and are admirably lighted and thoroughly ventilated. For gross dissection there is a large general laboratory, and adjoining the dissecting room is a smaller laboratory for special work, fitted with a hood and other facilities for digestion, maceration, and the making of corrosion specimens. At the end of the main dissecting room is another laboratory for topographical and regional dissection; also a large dark room with a projection outfit and facilities for drawing sections for making reconstructions. Upon this floor is also situated a dark room with a complete outfit for taking photographs of special preparations for illustrating research. In the basement is a compressed air apparatus for embalming and making special injections.

There is an abundance of anatomical material, which is embalmed and kept in cold storage so as to be ready for use when needed. The refrigerating apparatus is also used for freezing specimens for sections. In addition to the undissected material, there is ample supply of special parts, such as bones, brains, the various abdominal and thoracic organs, special sense organs, etc.

The equipment includes dissecting microscopes, glassware, reagents, and other necessities of an anatomical laboratory.

In connection with histology and embryology, every facility is offered for studying anatomical problems from both the gross and the developmental points of view.

In the library are to be found complete series of practically all of the important periodicals dealing with anatomy, and the proceedings and transactions of the learned societies. In addition, the library is well supplied with the most important anatomical monographs and books.

Graduate work in anatomy should be preceded by courses in general biology and comparative anatomy. A reading knowledge of German and French is essential for the most successful research in anatomy.

Anatomy. Dissection of the upper extremity; dissection of the head and neck; dissection of the thorax; thoracic and abdominal viscera, section demonstrations; dissection of the lower extremity; dissection of the abdominal and pelvic walls and viscera.

Central Nervous System, Gross Anatomy. Laboratory work with occasional demonstrations. Professor KERR.

Anatomy. Advanced work and research. Professor KERR and Assistant Professor SCHAEFFER.

Anatomy of the Live Body. Assistant Professor SCHAEFFER.

Anatomy. Detailed topographical dissection and study of any region. Professor KERR and Assistant Professor SCHAEFFER.

Anatomy. Dissection of the entire human body. Professor KERR and Assistant Professor SCHAEFFER.

COMPARATIVE PATHOLOGY AND BACTERIOLOGY

Professors: V. A. MOORE; S. H. BURNETT.

The laboratories in comparative pathology and bacteriology are well equipped for research in general pathology, the pathology of infectious diseases, and for bacteriological work especially in connection with animal bacterial flora, pathogenic organisms, and problems associated with the morphology and physiology of bacteria and their products. The library facilities are good.

Candidates for advanced degrees should have had courses in general pathology and bacteriology equivalent to the corresponding courses of the veterinary curriculum.

Research in Bacteriology and Pathology.

Laboratory Methods of Diagnosis and Meat Inspection.

Clinical Examination of the Blood. Assistant Professor BURNETT.

VETERINARY PHYSIOLOGY

Professor: P. A. FISH.

Instructor: C. E. HAYDEN.

There is a good equipment available for the study of physiologic problems in connection with the domesticated animals. The laboratories, located in the Veterinary College, are large and are provided with ample

modern apparatus for such research as can best be conducted in the laboratories. In the same building there is a well assorted collection of recent books and periodicals on comparative physiology, which may be supplemented by the many works on general physiology in the University Library.

The Veterinary Experiment Station, controlled by the college, and not far distant, can be utilized for field observations and the study of those problems outside of the scope of the laboratory. This unusual combination of field and laboratory research should be conducive to important results.

As a preparation and aid in this research, attendance at the general lecture and laboratory courses in veterinary physiology is recommended.

Physiology Recitations; The Physiology and Sanitation of the Domesticated Animals; The Physiology of the Muscular and Nervous Systems; Physiological Laboratory; Course in Urine Analysis; Advanced Physiology.

SOIL TECHNOLOGY

Professors: T. L. LYON; E. O. FIPPIN; J. A. BIZZELL.

The facilities for graduate study in this subject may be divided into two groups: first, those of the research laboratory in charge of Professor LYON and Professor BIZZELL; and second, those of the teaching laboratory in charge of Professor FIPPIN.

The research laboratory is primarily concerned with investigation and is open, except in unusual cases, only to graduate students who are working upon their major subject.

The laboratory is planned for chemical, bacteriological, and physical investigations of soil. The object has been so to equip it that a soil problem may be attacked through any of the known means of soil study. The usual facilities for the chemical analyses of soils and plants are at hand, and permit the determination of all of the constituents of the soil concerned in plant nutrition. For bacteriological work the laboratory contains in its equipment an autoclav of the largest size, sterilizers, incubators for different temperatures; and for mechanical soil analyses, a centrifuge, a shaking machine, and other necessary apparatus. Two greenhouses provide opportunity for conducting crop tests of soils during the winter, and for experiments with nutrient solutions and sand cultures. A field for plat experiments gives ample facility for work on a larger scale. In this field a series of large concrete tanks each holding between three and four tons of soil has recently been built. Pipes from these tanks carry the drainage water into a tunnel where it is collected for measurement and analysis. These varied and extensive facilities afford opportunity for students trained in any one or more of several sciences to investigate soil or plant nutrition problems.

In the teaching laboratories, special sections are set apart for graduate study. These are supplied with ample materials and are supplemented by work rooms and ample glass-house space.

The general laboratory is equipped with many types of apparatus for soil study, including centrifugal apparatus for mechanical analyses, constant temperature ovens, aspirators, titration apparatus, pressure filter pumps, etc.

There are in addition several hundred samples of soils from all parts of the United States for comparison and classification. All the soil maps of the United States arranged in form for ready reference, and all the literature relating to the various phases of soil study to be found in the departmental and University Library collections are available. The laboratories are supplemented by extensive field plats, and the University farm is used for the investigation of many problems which require that type of equipment.

The advanced courses are accompanied by laboratory courses and are designed as a preparation for research.

Principles of Soil Management. Prerequisite to all other courses in the subject.

Soils of the United States.

Soil Surveying.

Advanced Soils Lectures. Preliminary to research.

Manures and Fertilizers.

Drainage and Irrigation.

Advanced Soil Laboratory. Preliminary to research.

Research in Soils.

Soil Seminary. Required of all graduate students.

RURAL ECONOMY

Professor: G. N. LAUMAN.

It is not expected that all students of the subject will have a general knowledge of scientific agriculture in addition to training in economics and history; but for those who expect to specialize in this subject, a knowledge of the technical side of agriculture is strongly recommended. Many problems, however, may be successfully studied without the more technical training.

The library collections, general and departmental, are unusually complete. Much attention has been given to collecting the literature dealing with the economic and social conditions of agriculture in Western Europe. The literature of the technical side of agriculture, containing as it does a wealth of data as yet little used, is available in considerable fullness.

As many non-technical rural problems are best studied by actual contact with the population, the close relations maintained by the College of Agriculture in its extension work may be made an important aid to the student.

FARM MANAGEMENT AND FARM CROPS

Professors: G. F. WARREN; P. J. WHITE.

Instructors: K. C. LIVERMORE; A. L. THOMPSON.

The diverse types of farming which are carried on in New York State offer unusual advantages for the study of farm management. Some of the best and some of the poorest farms in the state are within easy reach of Ithaca. The agricultural survey work and other farm management investigations have furnished a large amount of new material for research.

The equipment includes laboratories and collections for the study of farm crops. There is also a departmental reading room with the books most frequently needed.

Graduate students who take farm crops as a major subject are expected to take the farm crops courses listed below, and must prepare an acceptable thesis based on original investigation. Those who take their major subject in farm management must prepare a similar thesis and take the farm management courses listed below. Students who are taking a minor subject may arrange to take much of their work in the following courses.

Cereals. Assistant Professor WHITE.

Forage Crops. Assistant Professor WHITE.

Advanced Farm Crops. Assistant Professor WHITE.

Research. Professor WARREN and Assistant Professor WHITE.

Farm Management. Professor WARREN and Mr. LIVERMORE.

Advanced Farm Management. Professor WARREN and Mr. LIVERMORE.

Research. Professor WARREN and Mr. LIVERMORE.

Seminary. Professor WARREN, Assistant Professor WHITE, and Mr. LIVERMORE.

ANIMAL HUSBANDRY

Professors: H. H. WING; M. W. HARPER; E. S. SAVAGE.

Instructor: G. W. TAILBY, JR.

Among the herds and flocks belonging to the College of Agriculture may be mentioned the dairy herd of fifty cows, a flock of about fifty sheep of various breeds, and a good-sized herd of breeding swine. The equipment for animal husbandry includes a very full collection of the herd and flock registries of all the breeds of domestic animals kept in this country, amounting to more than one thousand volumes, and affording excellent facilities for studies in heredity and genetics. Further work may be carried on in problems of animal nutrition based on investigation with the animals themselves.

Animal Husbandry; Meat and Milk Production; Practice in Feeding and Stable Management; The Horse; Mechanics of the Horse; Advanced Stock Judging.

Advanced Course in the Principles of Breeding Animals. Professor WING and Assistant Professor HARPER.

Advanced Course in the Principles of Feeding. Professor WING and Assistant Professor SAVAGE.

POULTRY HUSBANDRY

Professors: J. E. RICE; C. A. ROGERS.

The equipment includes a number of different breeds of fowls with which to carry on feeding and breeding experiments, and is provided with appliances for investigation in incubation and brooding. The laboratory contains facilities for anatomical work. In addition to a very complete set of bulletins

in the poultry library, assembled from the various experiment stations in the United States and Canada, numerous books on poultry husbandry are available in the University Library, the library of the Agricultural College, and the special departmental library, also a topical card index, with cross references, of the principal poultry books, bulletins, and magazines; a large mass of data from research; about 2000 negatives, a large number of which have to do with poultry investigations.

Owing to the fact that very few colleges give the undergraduate courses in poultry husbandry which are prerequisite to taking graduate work in this subject, very few students coming from other colleges can enter immediately upon graduate work. Most students will find it necessary to take a year of undergraduate courses before beginning graduate work.

Courses of instruction of an advanced nature can be taken along the lines of poultry feeding, breeding, and, in cooperation with the staff of the Veterinary College, in poultry disease investigations; in cooperation with the staff in agricultural chemistry, incubation and nutrition investigations; and in cooperation with the staff in histology and embryology, incubation experiments.

Poultry Husbandry; Feeding and Management; Incubator and Brooder Practice; Advanced Judging; Poultry Farm Management; Research; Seminary.

DAIRY INDUSTRY

Professors: W. A. STOCKING, JR.; H. E. ROSS.

Instructors: E. S. GUTHRIE; L. B. COOK.

The different laboratories for this subject are well equipped with apparatus for special lines of work and offer good opportunities to graduate students for research.

Before taking up graduate work in this subject, it is very desirable that a student should have Chemistry Course 6 or its equivalent and Bacteriology Course 4 or its equivalent.

To a limited number of graduate students intending to fit themselves for teaching dairy industry the department is able to give an opportunity for work in instruction in the different laboratories during the winter course.

Milk Composition and Tests; Butter Making; Cheese Making; Elementary Bacteriology; Dairy Mechanics; Market Milk and Milk Inspection; Dairy Building Equipment and Business Methods; General Agricultural Bacteriology; Bacteriology for the Home.

Advanced Testing Laboratory Course. Assistant Professor Ross.

Dairy Bacteriology. Professor STOCKING and Mr. COOK.

Butter Making. Advanced course. Mr. GUTHRIE.

Fancy Cheese Making. Professor STOCKING and Messrs. COOK and FISK.
Seminary. Professor STOCKING, Assistant Professor Ross, and Messrs. GUTHRIE and AYRES.

Research. Professor STOCKING, Assistant Professor Ross, and Mr. GUTHRIE.

MECHANICAL AND ELECTRICAL ENGINEERING

The Sibley College of Mechanical Engineering and the Mechanic Arts receives its name from the late Hiram Sibley of Rochester, who between the years 1870 and 1887, gave \$180,000 toward its endowment and equipment. Mr. Hiram W. Sibley has added more than \$130,000 for later constructions.

The main building is three hundred and seventy feet long, fifty feet in width, and three stories in height. It contains the reading room and reference library, drawing rooms, lecture rooms, offices, class rooms, and a large and well-lighted auditorium.

Franklin Hall is occupied on its first two floors and basement by the Department of Electrical Engineering, which in addition uses a portion of the basement of the main building for laboratories.

The Department of Experimental Engineering occupies a two story building one hundred and fifty feet long by forty feet wide, a gas engine laboratory forty by sixty feet, a boiler plant thirty by forty feet, an engine room forty by fifty feet, a refrigeration laboratory thirty by forty feet, and the east basement of the main building.

The machine shop and pattern shop occupy a two story building one hundred and fifty feet by forty feet; and the foundry and forge shops, a one-story building one hundred and eighty by forty feet.

The Shops are fully equipped throughout with standard hand and machine tools, selected with the view not only of giving manual instruction but also of illustrating modern manufacturing methods. The pattern shop has recently been completely re-equipped with new benches, lathes, and other power tools. The foundry contains five moulding machines of the various types and is equipped with a two-ton cupola, core ovens, crane, and over-head trolley, as well as with an ample supply of modern flasks and hand tools. The forge shop is equipped with twenty-eight standard forges and also contains a drop hammer, power shears, and punch press. The machine shop is equipped with twenty-five standard lathes, two shaping machines, one large radial drill press, two standard drill presses, one horizontal and one vertical boring mill, two semi-automatic lathes, one automatic lathe, two grinding machines, and one key-seater, as well as with an ample supply of small hand tools. This shop has been equipped particularly for the purpose of illustrating modern manufacturing methods.

The instruction in the Department of Experimental Engineering is given in several separate laboratories, each of which is thoroughly equipped with the machines, apparatus, and instruments necessary for instruction in research.

The Materials Testing Laboratory. This laboratory is equipped for tension and compression tests with an Olsen 300,000 pound machine, a Riehle 100,000 pound machine, a 200,000 pound Emery hydraulic machine, together with several other machines varying in capacity from 10,000 to 100,000 pounds. For transverse tests there is a Riehle machine of 200,000 pounds capacity and a Fairbanks machine of 10,000 pounds capacity. There are one Olsen torsion machine of 200,000 inch-pounds capacity, and two Thurston autographic torsion machines. The equipment includes measuring instruments, such as extensometers, a cathetometer, gas furnaces,

tempering baths, and other apparatus required for the determination of the physical qualities of engineering materials under tensile, compressive, transverse, and torsional stress, and under different kinds of heat treatment.

The Steam Laboratory. In this laboratory there is a 150 H. P. triple expansion Allis-Corliss engine so fitted up that it may be run as a simple, compound, or triple engine, condensing or non-condensing. There are also many smaller engines, including a McEwen, a Straight Line, a Russell, a Harris-Corliss, and two Payne engines. There are three surface condensers which may be connected up to these engines as desired. There is one 35 K.W. horizontal Curtis turbine and one 15 K.W. De Laval turbine. These turbines drive electric generators and may be run condensing or non-condensing.

There is a two-stage steam driven Ingersoll-Rand compressor, and three air-brake pumps of different types, together with meters, nozzles, and other instruments used in testing. The action of the air-brake may be studied in a complete brake equipment for a 25-car train. This part of the laboratory also contains several motor-driven fans, including one of the Sirocco type.

The equipment of apparatus and instruments used for engine testing comprises about 80 indicators of different types, about 75 steam gauges, a number of calorimeters for the determination of the quality of steam, speed counters, tachometers, planimeters, etc., besides a number of dynamometers of various kinds.

The boiler section of this laboratory has one 150 H. P. Babcock & Wilcox water-tube boiler of the marine type, and one 100 H. P. Babcock & Wilcox water-tube boiler of the standard type, both of which are fitted with internal superheaters. There is also one 80 H.P. Heine water-tube boiler and one 25 H. P. Roberts safety boiler connected with a Foster independent superheater. The auxiliary apparatus consists of a Cochran open heater, a Wainwright closed heater, steam pumps, traps, injectors, etc. A full set of scales, measuring tanks, gauges, flue gas apparatus, separating and throttling calorimeters, pyrometers, etc., complete the boiler equipment.

The Gas Engine Laboratory. The equipment consists of an 8 H. P. Westinghouse gas engine, an 8 H.P. Olds gasoline engine, an 8 H.P. Fairbanks gasoline engine, a 6 H.P. Hornsby-Akroyd oil engine, a 12 H.P. Priestman oil engine and a 16 H.P. Acme gas engine run on producer gas from a 15 H.P. suction gas-producer. A 50 H.P. suction gas-producer is in course of erection. This engine equipment is chosen to give as great a variety as possible in fuel used, type of governing, etc. Hot air engines are represented by one Rider and one Ericsson engine. This laboratory is well equipped for work of investigation and testing, having a special testing floor. The supply of testing instruments includes several outside-spring indicators, optical indicators, and a manograph. For temperature measurements there are available high reading thermometers and pyrometers of the expansion and electrical types.

The Hydraulic Laboratory. In this laboratory are several small water wheels of the Pelton type, a small American turbine, several rotary, and centrifugal pumps, and three hydraulic rams of different types and capacities.

For the determination of the flow of water there are weir boxes and weir tanks, weir notches of different types, nozzles, hook gauges, a current meter, and several Venturi tubes.

The Oil Testing Laboratory. This laboratory contains a Cornell oil testing machine, a Thurston standard railway testing machine and several smaller Thurston machines. The rest of the equipment consists of several viscosimeters of different types, together with the necessary hydrometers and thermometers.

The Refrigeration Laboratory. For the study of refrigeration in all its phases, the mechanical laboratory possesses a very complete York refrigerating plant having a capacity of 15 tons of ice, besides a Brunswick and a De La Vergne machine of small size.

The Cement Laboratory. This laboratory not only contains the ordinary apparatus for the testing of cement and concrete but in addition is equipped with crushing and grinding machinery and a small vertical kiln for making investigations on the manufacture of cement from raw material.

The Fuel Testing Laboratory. This laboratory contains a complete equipment of fuel calorimeters, and other apparatus needed for the determination of the composition and calorific value of fuel, whether gaseous, liquid, or solid.

The laboratory equipment includes apparatus for the study of power transmission, such as Morin and Webber transmission dynamometers, a Reeves variable speed transmission, and a belt testing machine, by means of which not only the efficiency of transmission but also the amount of belt slip and the coefficient of friction may be determined.

The Department of Electrical Engineering is fully equipped with modern apparatus for experimental lectures, laboratory practice, plant testing, standardizing of instruments, and investigation. This apparatus has been selected primarily to exemplify modern shop tests and to familiarize the student with the practical apparatus as well as with the theory of operation of electrical devices.

The Lecture Equipment. In addition to the usual complement of apparatus for demonstration, the lecture equipment includes an air-insulated, high-pressure transformer, with necessary regulators for subjecting insulators and insulating material to alternating pressures up to 60,000 volts. This can be supplemented by additional transformers for raising the pressure still higher. A 30,000 volt inductorium provides current for wireless telegraphy. All the standard equipment, as well as many pieces of specially designed apparatus, are employed to illustrate the operation of the principal laws applied in electrical engineering. Exhibits of apparatus, such as street railway car controllers, rail sections, insulating and line material, etc., are provided in profusion. This list includes a complete outfit for exhibiting in actual operation the multiple system of electric car control. An electric elevator and an overhead traveling crane system permit the laboratory motors and generators to be brought into the lecture room and class room for purposes of operation and illustration.

The Laboratories. The laboratory apparatus comprises a full complement of modern alternating and direct current machinery of all kinds. The alternating current equipment includes single and polyphase alterna-

tors and synchronous motors, induction motors, transformers, and all apparatus auxiliary thereto. A variety of direct current dynamos and motors suitably mounted for testing, cover the field of direct current machinery. There is a large supply of ammeters, voltmeters, and wattmeters of all types and ranges. A De Laval steam turbine geared to a direct-current generator, a direct connected marine set, circuit breakers, switches, water rheostats, and other auxiliaries are in use for plant test experiments. A 35 K.W. direct-connected turbo-generator is also available. The plant testing is done largely outside of the college buildings and for this purpose a large variety of ammeters, voltmeters, wattmeters, and other instruments are maintained in adjustment at a high standard of accuracy. These instruments have capacity great enough for testing the largest power plants. Special facilities are provided for the standardization of all electrical apparatus. Board of Trade and Reichsanstalt standards of resistance with large current carrying capacity, potentiometers and galvanometers, and reference standards of electro-motive forces are among the facilities provided for this purpose. In addition to the apparatus in the laboratories, the student may observe in operation a three-phase power transmission in the local power and lighting service. Large direct-connected generators, rotaries, constant current regulators and induction motors, as well as the lighting and railway system are convenient for inspection. The University has a modern hydro-electric plant containing large three-phase alternators direct driven by Doble impulse water-wheels. The power station also contains smaller units for direct current supply with all necessary auxiliary apparatus.

For use in connection with the investigations conducted in the Department of Engineering Research the equipment and resources of all departments of Sibley College are available, and in most instances, arrangements can be made to use the equipment of the scientific and engineering departments of the other colleges of the University.

In addition to the well equipped engineering library located in the college the student has access to the University Library and to the special libraries of the other colleges of the University.

The Sibley College of Mechanical Engineering and the Mechanic Arts comprises the following subjects: mechanics of engineering; machine design and construction; experimental engineering; power engineering; electrical engineering; engineering research. Advanced work is offered in all of these subjects and the several officers of instruction will assist and supervise the work of graduate students who may elect work with them. In addition, the staff in engineering research has been relieved of all undergraduate teaching and organized into a special body, the object of which is to assist all graduate students in whatever subjects they may have elected their work. This group of graduate teachers is in close touch with the laboratory work of the college and can thus render great aid in arranging material equipment.

Before a student may be a candidate for an advanced degree in any subjects in mechanical engineering he must have completed a course of study substantially equivalent to that outlined in the Announcement of Sibley College. In addition he must have had the substantial equivalent of the entrance

requirements of the college, which include three years instruction in either French or German.

The officers in the several subjects are as follows.

MECHANICS

Professors: E. H. WOOD; S. S. GARRETT; R. L. DOUGHERTY.

Instructors: W. R. CORNELL; H. M. DOUGLASS; H. MCCLURE; J. A. FRIED.

MACHINE DESIGN AND CONSTRUCTION

Professors: D. S. KIMBALL; G. R. McDERMOTT; H. D. HESS; C. D. ALBERT; L. D. HAYES; A. E. WELLS, Supt. of Shops.

Instructors: W. C. BALLARD; F. W. BUCK; C. A. CARPENTER; W. B. CORNELL; C. D. CORWIN; D. R. FRANCES; H. L. FREEMAN; S. J. FULLER; C. W. HAM; F. E. KLINCK; M. A. LEE; P. L. PEACH; W. R. STRAUS; C. E. TOWNSEND; J. T. WILLIAMS.

EXPERIMENTAL ENGINEERING

Professors: HERMAN DIEDERICH; G. B. UPTON.

Instructors: A. G. BIERMA; E. S. BURNETT; G. L. CURRENT; V. R. GAGE; W. H. HOOK; J. F. PUTNAM; C. E. TORRANCE; W. R. WIGLEY; S. R. WING.

POWER ENGINEERING

Professors: A. W. SMITH; W. N. BARNARD; C. F. HIRSHFELD; F. A. BURR.

Instructors: R. MATTHEWS; H. M. PARMLEY; P. W. THOMPSON; T. C. ULBRICHT; L. A. WILSON.

ELECTRICAL ENGINEERING

Professors: H. H. NORRIS; V. KARAPETOFF; G. S. MACOMBER; W. S. FORD.

Instructors: F. G. ANDERSON; D. S. COLE; J. F. H. DOUGLASS; A. D. DuBois; W. E. HOGAN; A. M. HOLCOMB; A. B. HOLCOMB; F. H. KROGER; J. G. PERTSCH; F. G. TAPPAN; J. F. STEVENS; C. H. TOWER.

ENGINEERING RESEARCH

Professors: R. C. CARPENTER; W. M. SAWDON.

Instructor: T. B. HYDE.

Aerial Engineering. Professor McDERMOTT.

Ship Design. Professor McDERMOTT.

The Structure and Strength of Ships. Professor McDERMOTT.

Resistance, Propulsion, and Powering of Ships. Professor McDERMOTT.

Advanced General Engineering Design. Professors KIMBALL, McDERMOTT, HESS, ALBERT, and HAYES.

Advanced Industrial Organization. Professor KIMBALL.

Engineering Research. Professors CARPENTER and SAWDON and Mr. HYDE.

Power Plant Testing. Professors CARPENTER and SAWDON and Mr. HYDE.

Heating and Ventilating. Professor CARPENTER.

Mechanical Refrigeration. Professor DIEDERICHS.

Advanced Heat-Power Engineering Design. Professors SMITH, BARNARD, and HIRSHFELD.

Research in Electrical Engineering. Professors NORRIS and FORD, and Messrs. HOLCOMB, HOGAN, DUBOIS and STEVENS.

Advanced Electrical Engineering. Professors NORRIS and KARAPETOFF.

The subjects listed below and any subject in the senior groups listed in the College Announcement may be taken as minor subjects. Courses in civil engineering, physics, chemistry, or geology may also be offered as minor subjects with the approval, as before, of the special committee.

Steam Boiler Design. Professor BARNARD.

Steam Turbines. Professor BARNARD.

Gas Manufacture and Distribution. Professor HIRSHFELD.

Gas Power Machinery. Professor HIRSHFELD.

Motor Car Design. Professor CARPENTER.

Structural Engineering. Professor McDERMOTT.

Design of Electrical Machinery. Professor KARAPETOFF.

Generation and Distribution of Electrical Energy. Professor FORD.

Telephone Engineering. Professor MACOMBER.

Advanced Electrical Railway Practice. Professor NORRIS.

Wireless Telegraphy and Telephony. Mr. KROGER.

Engineering Mathematics. Professor KARAPETOFF.

Current Electrical Topics. Professor NORRIS.

CIVIL ENGINEERING

Graduate work is offered in the following subjects in the College of Civil Engineering.

GEODESY AND ASTRONOMY

Professors: O. M. LELAND, Geodesy and Astronomy; S. L. BOOTHROYD, Topographic and Geodetic Engineering.

Instructors: P. H. UNDERWOOD; L. A. LAWRENCE; J. C. McCURDY.

The geodetic equipment is one of the most complete in the country. The library facilities in this subject are also unusual, embracing the principal books relating to geodetic work in all parts of the world.

The Fuertes Observatory is a brick building eighty feet long. It contains a transit room with four piers; three domes, one of which contains an equatorial telescope, while the others are used for altazimuths; a clock room with piers for level trier and pendulum apparatus; two computing rooms; and an instrument room.

The metric laboratory for the comparison of standards of length is in the basement of Lincoln Hall and is especially constructed with double walls so as

to have as nearly a constant temperature as practicable. It contains the four-meter comparator and a pier for gravity determinations.

The following outline shows various classes of work that may be undertaken in this subject and the character of the equipment.

Geodesy and Geodetic Methods. The works of Crandall, Jordan, Helmert, and others may be used for special reading. The publications of the United States Coast and Geodetic Survey and of the International Geodetic Association are available for reference.

Geodetic Astronomy. Determinations of time, latitude, longitude, and azimuth are considered. Chauvenet's, Doolittle's, and Hayford's books on this subject may be used as texts.

In connection with the study of star positions, the library contains an assortment of the standard catalogues of stars and the publications of many of the leading observatories of the world. Direct observations may be made with the equatorial telescope of four and one-half inches aperture. This instrument is also suitable for observations of the positions of comets, the components of the easily separated double stars, etc., and the theoretical studies may include similar topics.

For the practical work at the observatory, the equipment includes, besides the equatorial telescope, an astronomical transit by Troughton & Sims; a meridian telescope and two zenith telescopes by Fauth, one of the latter being adapted to photographic methods; altazimuths by Troughton & Sims and Fauth; a Howard mean-time clock; chronometers by Negus and Nardin; and surveyor's transits, sextants, and auxiliary instruments of various kinds.

Adjustment of Observations. Observations of a geodetic nature will be considered, or this work may be made to apply to other lines of investigation if desired, such as physics, mechanics, and hydraulics. A general treatment of the method of least squares may be given if desired.

Terrestrial Magnetism. A Kew magnetometer, a Barrows dip circle, and a declinometer afford means for investigating the magnetic elements.

Gravity. One of the piers of the department has been occupied as a gravity station by the U. S. Coast and Geodetic Survey, and is therefore connected, through Washington, with the absolute determinations made at Potsdam, Germany.

The instrumental equipment for this class of work includes, besides a Kater pendulum, a Mendenhall half-second pendulum apparatus of the pattern used in the U. S. Coast and Geodetic Survey, the pendulums being swung in a partial vacuum. The literature of this subject is well represented in the library.

Standards of Length. For the study and comparison of measures of length, the metric laboratory is provided with a four-meter comparator with micrometer microscopes and carriage movable transversely to accommodate two or more measures simultaneously, an ice-bar apparatus, etc. This comparator is in a case for protection from sudden changes of temperature, and the laboratory temperature is fairly constant. A four-foot comparator is available for the direct study and graduation of leveling rods.

For the investigation of the behavior of apparatus, especially tapes, under field conditions, and also for the standardization of tapes, a 100-meter com-

parator has been constructed and the auxiliary instruments are in process of manufacture. The end marks are under ground and well isolated from surface disturbance. Micrometer microscopes on the piers above these marks will be referred to them by means of Repsold cut-off tubes, the tapes being observed directly through the microscopes. In this work, a 50-meter Invar tape will be used, whose standardization has been made with exceptional precision by the National Bureau of Standards.

The graduation of scales, as well as their study, is facilitated by means of a dividing engine made by the Société Générale. For the most delicate graduation work, the large Rogers dividing engine in the Department of Physics is available.

The laboratory standard of length is a steel meter bar of the international type, by the Société Générale. It has been compared with an international prototype at Washington. A Rogers four-inch and decimeter scale on speculum metal, accurately compared, and a brass line-and-end-measure yard are also available.

Investigation of Instruments. In addition to the special equipments mentioned above, considerable apparatus of an auxiliary character for the investigation of instruments is at hand. Notable pieces are the large Dodge-Mayhew level-trier, a spherometer with special adaptation for the study of pivots, a pair of pier collimators, micrometer microscopes, etc. Also, there are the usual engineering instruments of many types, transits, theodolites, heliotropes, levels, and meteorological instruments. For standards of temperature, there are several precision thermometers, by Boudin, Tonnelot, and others, some of which have been standardized at the International Bureau at Paris. A special comparator is available for the calibration of thermometers, and there is a pyrometer for the study of high temperatures.

The work arranged especially for graduate students may be divided into the following courses.

- a. Theoretical Geodesy and Geodetic Methods.
- b. Advanced Geodetic Astronomy.
- c. Advanced Adjustment of Observations.
- d. Geodetic Laboratory and Field Investigations.

The character of the work, as well as the amount of time to be devoted to it, will be arranged with each student. It is usually desirable that the theoretical reading be accompanied by illustrative laboratory practice, and in the more advanced portions of his work the student will generally devote most of his time to special investigations.

The preparation necessary for graduate work in geodesy and astronomy should include, in particular, general courses in physics, chemistry, and mathematics (including differential and integral calculus), as well as the usual undergraduate work in surveying and mechanics. The ability to read German scientific works is almost indispensable.

Elementary Surveying; Advanced Surveying; Topographic and Geodetic Survey (Camp); Cartography.

Geodetic Surveying. Assistant Professors LELAND and BOOTHROYD and Mr. UNDERWOOD.

Least Squares; Adjustment of Observations. Mr. UNDERWOOD.

Geodesy and Least Squares. Assistant Professor LELAND.

Geodetic Astronomy. Assistant Professor LELAND.

Advanced Topographic Surveying. Assistant Professor LELAND.

APPLIED MECHANICS AND HYDRAULICS

Professors: I. P. CHURCH; S. G. GEORGE; A. P. MILLS; E. W. RETTGER; E. W. SCHODER; F. J. SEERY; K. B. TURNER; C. L. WALKER.

Instructors: E. V. BARON; J. F. BRAUNER; N. W. DOUGHERTY; L. A. LAWRENCE; W. H. MORRIS; E. H. TAYLOR.

The technical library in Lincoln Hall contains a full collection of the important books dealing with applied mechanics and hydraulics, complete sets of all representative engineering periodicals, journals of the principal technical societies, and government reports on technical investigations.

The Cement Laboratory contains machines for tension tests, compression machines of from two to two hundred tons capacity, an impact machine, and a special machine for determining automatically the rate of setting and hardening of cement. For direct experiment with cement there is also provided a large number of tension and compression briquette moulds, a water tank with capacity for the storage of three thousand briquettes, a moist oven with a capacity of seven hundred briquettes, and three drying ovens; scales, slate and plate-glass mixing tables, thermometers, a Bunsen pump for determining permeability, several sets of apparatus for measuring linear and volume changes during setting, and apparatus for determining specific gravity, normal consistency, and time of set, and constancy of volume by normal and accelerated tests; also standard sieves for determining fineness, and apparatus for determining voids in sand and stone.

The Equipment of the Testing Laboratory for materials of construction and for full sized members, joints, and structures includes: a Riehle 400,000 lb. testing machine with a capacity for beams and girders up to 19 inches in width and to 18 feet in length and for specimens in tension and compression up to 12 ft. in length; a Riehle 100,000 lb. testing machine, and an Olsen 50,000 lb. machine; an Olsen 10,000 lb. wire testing machine; a Thurston autographic torsion testing machine; a Riehle torsion testing machine of 60,000 inch-pounds capacity, for testing rods and shafts up to one and a half inches in diameter and six feet in length; a Riehle 5,000 lb. transverse load testing machine for flexural tests of bars of wood and metal up to four feet in length; an Amsler-Laffron compression testing machine; a standard Page impact machine for tests of road material; a Riehle grinder for stone specimens; a standard Deval machine for abrasion tests of road material; and a standard rattler for paving brick.

The equipment also includes a set of torsion clinometers for use with the Riehle torsion machine; a Henning extensometer for tension tests of metals, and two self indicating dial extensometers with fittings which adapt them for use in testing steel or iron tension or compression specimens, and also for

testing full sized concrete beams and columns and for tests of wire. The Martens mirror extensometer is also available. Knock-down forms are provided for the making of large concrete beams and columns.

Mechanics of Engineering. Professor CHURCH and Assistant Professors GEORGE, RETTGER and TURNER, and Instructors BARON and BRAUNER.

Engineering Laboratory. Professor CHURCH, Assistant Professors MILLS and WALKER, and Instructors BARON, BRAUNER, DOUGHERTY, LAWRENCE, MORRIS, and TAYLOR.

Hydraulics. Professor CHURCH, and Assistant Professors RETTGER, SCHODER, and TURNER.

Materials of Construction. Assistant Professor MILLS.

Advanced Mechanics. Professor CHURCH.

Special Courses in Advanced Mechanics for Graduates. Professor CHURCH.

Engineering Problems. Professor CHURCH, Assistant Professors GEORGE and SEERY, and Instructor BRAUNER.

Testing Materials. Professor CHURCH and Assistant Professor MILLS.

Hydraulic Constructions. Assistant Professor SEERY.

Water Power Engineering. Assistant Professor SEERY.

Engineering Design in Hydraulic Engineering. Professor CHURCH and Assistant Professors GEORGE and SEERY.

EXPERIMENTAL HYDRAULICS

Professors: E. E. HASKELL; E. W. SCHODER; K. B. TURNER.

The Hydraulic Laboratory by reason of its unique location and unusual facilities is adapted to investigations of great value to hydraulic science and the engineering profession. The water supply is obtained from Fall Creek with a watershed of 126 square miles. Beebe Lake, a pond of about 20 acres, has been formed by the construction of a concrete dam 26 feet high, with a spillway crest length of 130.5 feet. At one end of the dam there is an additional flood spillway 141.5 feet long. A rectangular canal 420 feet long and 16 feet wide is supplied from Beebe Lake through six headgates for controlling the amount of flow. The upper portion of the canal is 17.7 feet deep and the lower portion is 10 feet deep. In this canal are two sharp crested weirs 16 feet long over which discharges as large as 400 cubic feet per second may be passed.

A branch canal 6 feet wide leads from the lower end of the large 16-foot canal into the upper portion of the laboratory building which is built against the cliff of the gorge. This branch canal may also be supplied directly from Beebe Lake by means of a 48-inch cast iron pipe line with a short 30-inch branch at its lower end. Two sluice gates control the flow from the large canal, and a 30-inch valve controls the flow from the 48-inch pipe into the 6-foot canal. The 6-foot canal within the laboratory building discharges either to waste into the pool below Triphammer Falls (a sheer drop of 60 feet) or into the upper end of a steel standpipe 6 feet in diameter and 60 feet high. A suitable mechanism causes an instantaneous diversion of dis-

charges as large as 60 cubic feet per second from the waste flume into the standpipe or vice versa. The 6-foot standpipe is provided at the bottom with a 36-inch discharge valve operated by hydraulic pressure. There is a float gage indicating accurately the height of the water surface in the standpipe.

The lower portion of the large 16-foot canal, 350 feet long between weirs, is used for measurements with floats and current meters. An electrically operated car spans this canal and is used for rating the current meters. Models of dams may be built in the canal and the flow over them investigated with precision.

There is an outdoor equipment for pipe flow experiments with pipes as large as 6 inches in diameter with a concrete tank for precise measurements of flow. The 3-inch pipe line supplying the University filtration plant is available for experimentation, giving a head of 225 feet.

A concrete Cippoletti weir with steel edges and with a crest length of 16 feet, and depth of notch of 6.5 feet is built in the gorge below Beebe Lake dam and serves to measure the creek flow to calibrate the dam and the 5-foot flood gate in the dam.

Part of the equipment of the University power plant may also be used for certain kinds of hydraulic experimentations. The available head here is 135 feet.

Prospective graduate students should bear in mind that only under very rare circumstances can a candidate for the master's degree, or even the doctor's degree, hope to handle an experimental investigation in hydraulics involving large flows of water up to the capacity of the laboratory or involving extensive constructions. The limitations of seasonal availability of water and of weather conditions, as well as of time, labor, and expense, are such that the graduate student in this subject should look forward to investigations of lesser apparent magnitude, but often of equal value.

Hydraulic Measurements. Professor HASKELL and Assistant Professors SCHODER and TURNER.

Experimental Hydraulic Motors and Pumps. Assistant Professor SCHODER.

Advanced Experimental Hydraulics. Professor HASKELL and Assistant Professor SCHODER.

SANITARY ENGINEERING

Professors: H. N. OGDEN; C. L. WALKER.

The courses offered to graduate students may be divided into two classes: those dealing with the design, construction, and operation of sewage disposal plants and of water purification plants; and those fundamental studies in chemistry, biology, and bacteriology, which the undergraduate student in civil engineering may not have been able to pursue.

A sewage disposal plant in the city of Ithaca offers opportunity for experimental study of septic action and of sedimentation. Within a short distance from Ithaca are five other plants, well adapted for critical examination of

efficiencies. Numerous other opportunities are offered for the study of similar questions.

The laboratories in all the related subjects are open to graduate students in sanitary engineering. The courses in organic chemistry are well adapted to the study of the disposal of trade wastes. The courses in mycology and botany afford excellent opportunity for studying the life history of algæ and other water plants which affect both stream pollution and purification. The courses in bacteriology deal not only with water bacteria and the colon types but also with pathogenic forms interesting from the point of view of epidemiology. The courses in the Medical College enable the student to trace the effect of the pollution of water supply and to acquire a working knowledge of the water-borne diseases. Finally, the branch of the State Hygienic Laboratory, established in the College, gives an unequalled opportunity for students to acquire not merely laboratory technique in water analysis, but also a practical training in the forms of interpretation. This laboratory is also available for experimental studies of the efficiency of water and sewage plants and of methods of dealing with the refuse from factories. The library is well provided with the literature of the subject.

Municipal Engineering.

Purification of Water.

Conference on present methods of sewage disposal.

A Laboratory Course devoted to some special problem of sewage or water.

The following courses in other subjects in the University may profitably be taken up by graduate students in Sanitary Engineering: History and Political Science, Course 76a; History and Political Science, Course 96; Chemistry, Course 30; Chemistry, Course 75; Botany, Course 11; Entomology, Course 19; Medical College, Course 43.

RAILROAD ENGINEERING

Professors: C. L. CRANDALL; F. A. BARNES.

Instructor: L. V. EDWARDS.

The library contains an excellent collection of books, periodicals, and proceedings of engineering societies on railroad construction and operation covering American and European practice for both steam and electric roads. Surveys and maps of locations made by the undergraduate classes during many years form an excellent basis for study and for comparison of alternative routes with existing lines. Standard plans and other data have also been contributed from time to time by railroad companies and others for the use of the department.

The college laboratories for experimental hydraulics and cement work, and for the study of the strength and other properties of the materials for track and structures, are available for those specializing in this field.

Railroad Surveying, Construction and Economics. Prerequisite for graduate work.

Railroad Maintenance of Way. Professor CRANDALL.

Railroad Operation and Management. Assistant Professor BARNES.

These two courses will not be accepted as part of a major subject unless they are accompanied by special work and reports.

Railroad Engineering Design. Professor CRANDALL.

Special Courses. Special courses of investigation and study will be arranged to meet individual needs.

Attention is called to the facilities available in other subjects in the University to supplement the work above outlined, as for example, in political science the course on railroad transportation and, in electrical engineering, courses dealing with the applications of electricity to the operation of railroads.

BRIDGE ENGINEERING

Professors: H. S. JACOBY, Bridge Engineering; DONALD DERICKSON Structural Engineering.

Instructors: R. P. DAVIS; R. M. BOWMAN; E. N. BURROWS.

In this subject instruction is offered in the determination of loading, stresses, and design of roofs, buildings, bridges, arches, foundations, piers, retaining walls, and other structures of timber, steel, reinforced concrete, and masonry.

A collection of over seven thousand blue prints is available, giving detail plans of American railroad and highway bridges, roof trusses, steel buildings, and various structures of reinforced concrete and masonry, and there are also about one thousand selected photographs of all classes of bridges designed in this country.

The twenty-six bound volumes of blue prints used for office reference by the late George S. Morison, which contain the plans of all the bridges designed under his direction as consulting engineer, form a part of the reference library.

The library contains practically all the important books on bridge and structural engineering. It also contains a valuable collection of theses, those on original investigations relating to arch bridges being especially noteworthy. These investigations have been conducted so as to form an extended and closely related series. Their results constitute an important addition to previous knowledge of the relative strength, stiffness, and weight of different types of construction, and of the methods for their investigation and design.

In order for a student to qualify for graduate work in the subject of bridge engineering, he must be a graduate of a course in civil engineering of an institution of recognized standing.

Structural Details and Bridge Design. Preliminary.

Reinforced Concrete Arch. Assistant Professor DERICKSON and Messrs. BOWMAN and BURROWS.

Higher Structures. Professor JACOBY.

Masonry and Foundations. Professor JACOBY and Mr. DAVIS.

Steel Buildings. Assistant Professor DERICKSON.

Concrete Construction. Assistant Professor DERICKSON and Messrs. DAVIS and BOWMAN.
 Engineering Design. Professor JACOBY and Assistant Professor DERICKSON.

ARCHITECTURE

Professors: C. A. MARTIN; JEAN HEBRARD; O. M. BRAUNER; A. C. PHELPS; GEORGE YOUNG.

Instructors: H. S. GUTSELL; G. R. CHAMBERLAIN; G. R. THOMPSON; CHRISTIAN MIDJO; J. M. KELLOGG.

Graduate work is offered in architectural design; the history of architecture, painting, and sculpture; advanced construction; and drawing, painting, and modeling in their relation to design in architecture.

For the master's degree either architectural design or the history of architecture may be elected as a major subject; minor subjects may be taken in construction, drawing, painting, modeling, or in a wide variety of special subjects in the general field of history or research in architecture and the allied arts of painting, sculpture, decoration, and the arts and crafts.

Candidates for the master's degree in architecture must be graduates of schools of equal standing with the College of Architecture, and their training in design or other subjects elected for graduate work must be equivalent to the training required in this college for the degree of Bachelor of Architecture.

The equipment and facilities within the limits of the work offered or undertaken are of the highest order. In addition to the library and rooms used for lectures, recitations, exhibition purposes, offices, etc., the college has nearly fifteen thousand square feet of floor space in studios devoted exclusively to the work in design and drawing. The large studios for the work in drawing from the antique, still life, and from life, are thoroughly equipped with full size plaster casts—several hundred in all—of sculpture from the best periods of the art; particularly from the Greek, Roman, and Italian Renaissance, with examples from the medieval and later Renaissance periods. The equipment for the work in color and modeling, which are taken only as minor subjects, is also excellent.

Supplementary to the equipment provided by the University Library there is a special library of works on architecture and the allied arts, surpassed in size by only one other in the country and surpassed by none in its accessibility and direct usefulness as a working and reference library. In addition to the books, portfolios, pamphlets, etc., there are several thousand choice photographs covering the entire field of architecture, about one thousand fine color reproductions of the masterpieces of painting, some nine thousand carefully selected lantern slides, and many original drawings made by masters of design and draftsmanship in architecture, all of which are directly accessible to the student.

All instruction is by direct and personal elbow-to-elbow discussion and criticism that gives to each pupil the utmost that his teachers and advisers have to give.

Freehand Drawing; Descriptive Geometry; History of Ancient and Medieval Architecture; Elements of Architecture; Shades and Shadows; Water Color Painting; History of Renaissance Architecture; Design; Drawing from the Antique; Masonry Construction; Perspective; Historic Ornament; History of Greek Sculpture and Italian Painting; History of Art in Italy; History of Art North of the Alps; Modeling; Planning of Domestic Buildings; Specifications; Working Drawings; Mechanics; Strength of Materials, etc.; Pen and Ink Drawing; Modern Architecture; Advanced Design; Life Class; Seminary; Historical Seminary: Fireproof Construction.

FELLOWS AND GRADUATE SCHOLARS

1910-11

UNIVERSITY FELLOWS

The Cornell Fellowship,

Allan H. Gilbert, A.B. (Cornell) 1909; A.M. (Yale) 1910. English

The McGraw Fellowship,

Everett Edgar King, B.S. (Rose Polytechnic Institute) 1901; C.E. (same) 1909; M.S. (same) 1910; A.B. (Indiana) 1910, Civil Engineering

The Sage Fellowship,

David Shepard Pratt, A.B. (Cornell) 1908, Chemistry

The Schuyler Fellowship,

Henry Ellsworth Ewing, A.B. (Illinois) 1906; A.M. (same) 1908, Entomology

The Sibley Fellowship,

Walter Calvin Wagner, B.S. in E.E. (University of Washington), 1907, Mechanical Engineering

The Goldwin Smith Fellowship,

Frederick Adolph Wolf, A.B. (Nebraska) 1907; A.M. (same) 1908, Botany

The President White Fellowship,

John Armor Veazey, A.B. (Westminster) 1902; A.B. (Cornell) 1906, Physics

The Erastus Brooks Fellowship,

Lewis Clark Cox, A.B. (Ohio State) 1905; A.M. (same) 1907, Mathematics

Horace Whittier Peaslee, B. Arch. (Cornell) 1910, Architecture

George Irving Dale, A.B. (Cornell) 1910, Romance Languages

Ernest Herman Hespelt, A.B. (Cornell) 1910, Germanic Languages

Martin John Prucha, Ph.B. (Wesleyan) 1903; M.S. (same) 1908, Agriculture

Frank Houston Swift, B.S. in EE (Oregon), Mechanical Engineering

PRESIDENT WHITE FELLOWS IN HISTORY AND POLITICAL SCIENCE

George Cline Smith, A.B. (University of Oklahoma) 1908.

Frederic Corss Church, A.B. (Cornell) 1909.*

FELLOWS IN POLITICAL ECONOMY

James Garfield Stevens, Ph.B. (Alfred University) 1906.

William Spring Stevens, A.B. (Colby College) 1906; A.M. (George Washington University) 1909.

*This fellowship has been made a traveling fellowship for the year 1910-1911.

FELLOWS IN GREEK AND LATIN

Charles Ernest Bennett, A.B. (Amherst College) 1905.

Bertha Caroline Peirce, A.B. (Swarthmore) 1906; A.M. (Cornell) 1907.

SUSAN LINN SAGE FELLOWS IN PHILOSOPHY

Austin Southwick Edwards, B.S. (Columbia) 1908; A.M. (Minnesota) 1910.

Charles Hamilton Williams, A.B. (University of Missouri) 1907.

James Reese Lin, A.B. (Emory College) 1887; A.M. (Vanderbilt) 1896.

HONORARY FELLOWS

Issa Tanimura, Ph.B. (Yale) 1891; LL.B. (Dickinson College) 1892; D.C.L.
(same) 1905, Agriculture

Edmund Jacobson, B.S. (Northwestern University) 1908; M.A. (Harvard)
1909; Ph.D. (same) 1910, Psychology

GRADUATE SCHOLARS IN THE SCHOOL OF PHILOSOPHY

Mabel Ensworth Goudge, B.A. (Dalhousie) 1908; M.A. (same) 1909.

John Raymond Tuttle, A.B. (Leland Stanford University) 1909.

Edith Corrinne Stephenson, A.B. (Ottawa University) 1909.

Katherine Everett, A.B. (Brown University) 1908; A.M. (same) 1910.

Christian Alban Ruckmich, A.B. (Amherst College) 1909.

Norbert Wiener, A.B. (Tufts College) 1909.

UNIVERSITY GRADUATE SCHOLARS

George Ellsworth Thompson, A.B. (Indiana) 1909; A.M. (same) 1910, Physics

Lee McBride White, A.B. (Wake Forest College) 1908, English

Katharine More Cochran, A.B. (Vassar College) 1890, Greek and Latin

Lucy Wright Smith, A.B. (Mt. Holyoke) 1909, Histology and Embryology

Marion Berger, A.B. (Cornell) 1910, Archaeology and Comparative Philology

George Wells Ely, Jr., C.E. (Princeton University) 1910, Civil Engineering

Louisa Stone Stevenson, A.B. (Vassar College) 1901, Chemistry

Stanley Eugene Brasefield, C.E. (Lafayette) 1895; M.E. (same) 1898,
Mathematics

Mabel Elisabeth Hodder, A.B. (Syracuse University) 1895; A.M. (University
of Minnesota) 1899; M.A. (Radcliffe College) 1904, History

David Truxton Wilber, A.B. (Cornell) 1910, Geology

COMMENCEMENT 1910

At the forty-second Annual Commencement, June 1910, advanced degrees were conferred as shown in the list below. The title of the thesis is given after the name of each candidate.

MASTERS OF ARTS

- Harry Philip Brown, A.B.: Secondary Thickening in *Pinus rigida*.
 George Elberton Burnap, B.S.: The Relation of Landscape Art to Rural Conditions.
 Ira Graessle Flocken, A.B.: Uniform Mortality Tables for Municipalities and States.
 Sidney Galpin, A.B.: The Effect of Quartz on Kaolin.
 Frederick Herbert Gilman, A.B.: Federal Supervision of Banks.
 William Samuel Hendrix, A.B., A.M.: A Proposed English Rendering of La Vie de Saint Alexis.
 Major Edward Holmes, B.S., A.B.: On the Electrolysis of Certain Liquid Ammonia Solutions.
 Walter Everett Hopper, A.B.: The Methods and Cost of Operation in the Caddo Oil Field, Louisiana.
 Millard Keys, A.B.: The Development of the Notion of the Definite Integral.
 Ida Langdon, A.B.: Materials for a Study of Spenser's Theory of Fine Art.
 Carleton Chase Murdock, B.S.: Low Temperature Thermometry.
 Edwin Charles Mayer, A.B.: The Diffusion of Gases through the Walls of Quartz Tubes.
 Frank Millett Morgan, A.B.: Configurations of Inflexions and Double Tangents on Certain Quartic Curves.
 George Arthur Perley, B.S.: Experiments on Solarization.
 Harry Ames Richards, A.B.: An Investigation of New England Mortality; with a Sketch of the History of Life Tables in General.
 Carl Abell Zeller, Ph.B., A.M.: A Study of Phosphorescence of Short Duration.

MASTERS OF SCIENCE IN AGRICULTURE

- Eroy Henry Anderson, B.S. in Agr.: An Apple Orchard Survey of Monroe County, New York.
 Maurice Chase Burritt, B.S. in Agr.: An Apple Orchard Survey of Monroe County, New York.
 Horace Branson Cowgill, B.A.: Studies of Variation and Heredity in the Potato (*Solanum tuberosum*).
 Maxwell Jay Dorsey, B.S.: A Study of the Variation of Certain Vine Characters in *Vitis bicolor* and *Vitis vulpina*.
 Asutosh Dutt, A.B., B.S. in Agr.: Pulvinaria, a Genus of Coccidae.
 Howard Brett Frost, B.S. in Agr.: Some Relations between Temperature and Variation with *Matthiola incana* and *Antirrhinum majus*.
 HingKwai Fung, B.S. in Agr.: A Study of the Cotton Industry.
 Edward Sewell Guthrie, B.S.A.: A Study of Rancidity in Some Dairy Products.

- Joseph Wynne Hungate, B.A.: The Cabbage Aphis (*Aphis brassicae*).
 Robert Louis Latzer, B.S.A.: The Effect of Pasteurization and Sterilization on the Solubility of Milk Proteids.
 Lai-Kuei Liang, B.S.: A Study of Alkali Soil with Particular Reference to the Relation of the Alkali Salts to Plant Growth.
 Merris Mickey McCool, B.S. in Agr.: The Antitoxic Action of Nutrient and other Mineral Bases.
 Philip Edward Smith, B.S.: Pseudococcus, a Genus of Coccidae.
 Clarence Cornelius Vincent, B.S., M.S.: A Monographic Study of *Juglans regia* Linn.

MASTERS OF CIVIL ENGINEERING

- Patterson Bain, Jr., B.S. in C.E.: Loss of Head in Pipe Specials.
 Harry Michael Spandau, C.E.: The Experimental Investigation of the Disposal of Dairy Wastes.

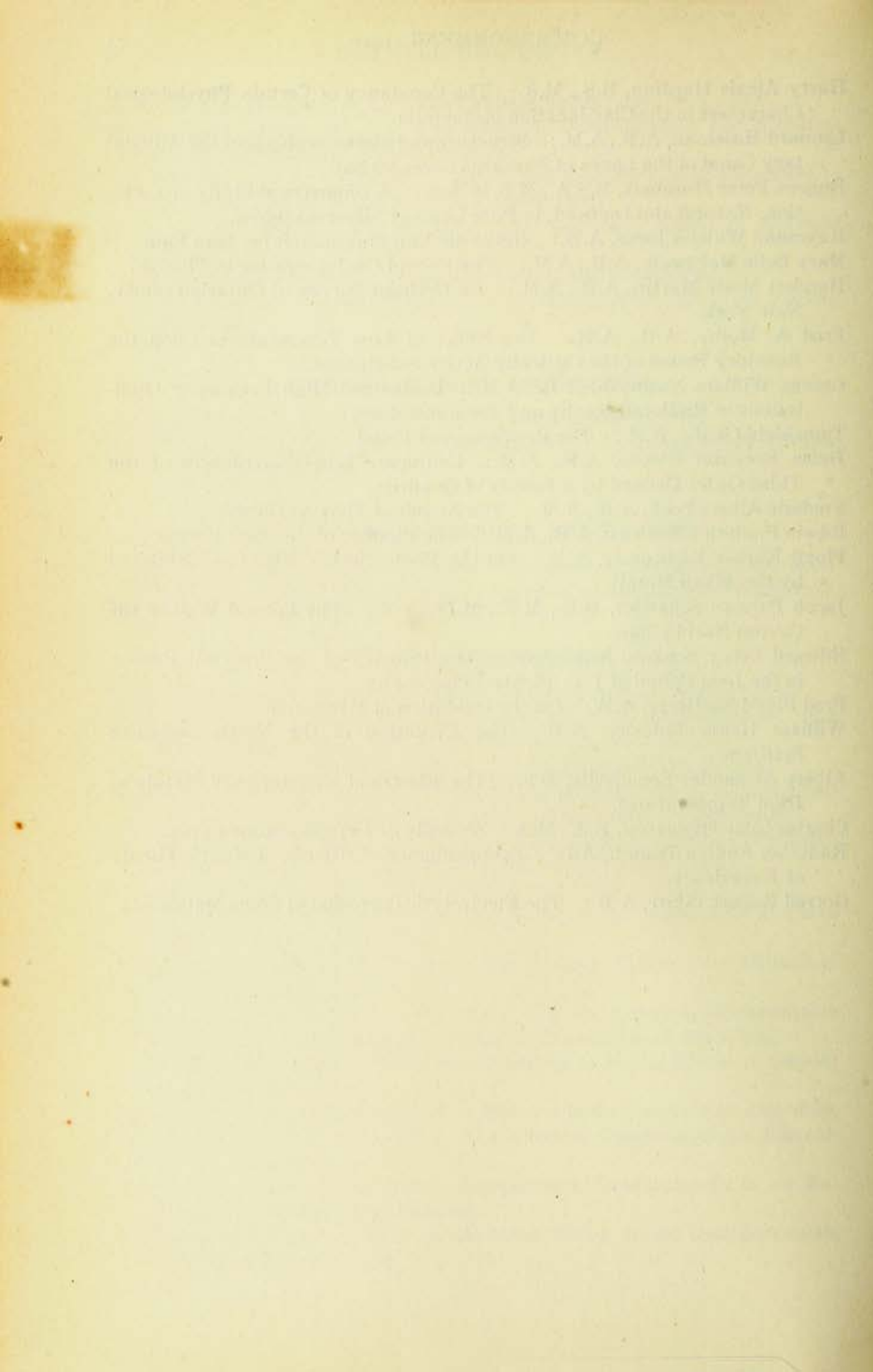
MASTERS OF MECHANICAL ENGINEERING

- Armin George Kessler, M.E.: Current Practice in Gas Engine Proportions.
 George William Lewis, M.E.: Current Practice in Gas Engine Proportions.

DOCTORS OF PHILOSOPHY

- James Theophilus Barrett, A.B., A.M.: Studies of Some Phycomycetes.
 James Chester Bradley, A.B., M.S.: The Wings of Hymenoptera, with Particular Reference to the Ichneumon Flies.
 Josephine Britton, A.B., A.M.: The Songs in the Elizabethan Drama.
 Harry Bates Brown, A.B., A.M.: The Form and Structure of Certain Plant Hybrids as Compared with the Form and Structure of their Parents.
 Ormond Butler, B.S., M.S.: A Study of Gummosis of Prunus and Citrus, with Observations on Squamosis and Exanthema of the Citrus.
 Helen Maud Clarke, A.B., A.M.: Conscious Attitudes.
 Harold Bartlett Curtis, A.B.: Hyperabelian Functions Expressible by Theta Series.
 George Charles Embury, B.S., M.S.: The Ecology, Habits, and Growth of the Pike (*Esox lucius*).
 Clarence Errol Ferree, B.S., A.M., M.S.: An Experimental Examination of the Phenomena Usually Attributed to Fluctuation of Attention.
 Otis Amsden Gage, Ph.B.: The Point Discharge in Air for Pressures Greater than One Atmosphere.
 Mitchell Bennett Garrett, A.B., A.M.: Barnave in the Constituent Assembly.
 Roswell Clifton Gibbs, A.B., A.M.: The Effect of Temperature on Fluorescence and Absorption.
 Horace Wadsworth Gillett, A.B.: Temperature Measurements in an Experimental Carborundum Furnace.
 Antoinette Greene, A.B., A.M.: A Glossarial Index to the Gest Hystoriale of the Destruction of Troy.

- Harry Alexis Harding, B.S., M.S.: The Constancy of Certain Physiological Characters in the Classification of Bacteria.
- Leonard Haseman, A.B., A.M.: Structure and Metamorphosis of the Alimentary Canal of the Larva of *Psychoda alternata* Say.
- Eugene Peter Humbert, B.S.A., M.S. in Agr.: A Biometrical Study of Variation, Natural and Induced, in Pure Lines of *Silene noctiflora*.
- Raymond Watson Jones, A.B.: Ueber die Empfindsamkeit bei Jean Paul.
- Mary Belle McElwain, A.B., A.M.: The Uses of the Imperative in Plautus.
- Harriett Marie Martin, A.B., A.M.: An Orchard Survey of Ontario County, New York.
- Fred A. Molby, A.B., A.M.: The Effect of Low Temperatures upon the Rotatory Power of the Optically Active Substances.
- George William Nasmyth, A.B., A.M.: Undamped High Frequency Oscillations in Radiotelegraphy and Radiotelephony.
- Tamekichi Okabe, A.B.: The Psychology of Belief.
- Helen Brewster Owens, A.B., A.M.: Conjugate Line Congruences of the Third Order Defined by a Family of Quadrics.
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- Floyd Karker Richtmyer, A.B.: On the Photo-electric Effect as Exhibited by the Alkali Metals.
- Jacob Parsons Schaeffer, B.E., M.E., M.D., A.M.: The Lateral Wall of the Cavum Nasi in Man.
- Edward Leroy Schaub, A.B., A.M.: The Primacy of the Practical Reason in the Jena Period of J. G. Fichte's Philosophy.
- Fred Floyd Shetterly, A.B.: On the Oxidation of Hydrazine.
- William Henry Shideler, A.B.: The Evolution of the North American Spirifers.
- Albert Alexander Somerville, B.S.: The Electrical Resistance of Metals at High Temperatures.
- Charles John Triggerson, B.A., M.A.: A study of *Dryophanta erinacei*.
- Radoslav Andrea Tsanoff, A.B.: Schopenhauer's Criticism of Kant's Theory of Experience.
- Gorrell Robert White, A.B.: The Electrolytic Corrosion of Some Metals.



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